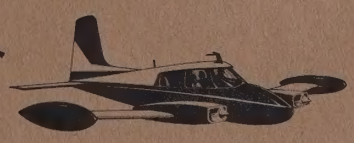
Preliminary Instructions

for

ARC TYPE CD-3

COURSE DIRECTOR



Aircraft Radio Corporation

Boonton, New Jersey

Preliminary Instructions

for

ARC TYPE CD-3

COURSE DIRECTOR

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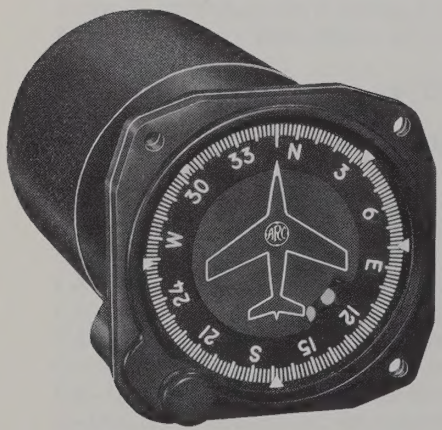
ARC TYPE CA-12A
COMPUTER AMPLIFIER

ARC TYPE C-92A
CONTROL UNIT

ARC TYPE IN-15A
SLAVING METER

ARC TYPE CT-11A
COMPASS TRANSMITTER



ARC TYPE G-13A
GYRO INDICATOR

ARC TYPE IN-14
COURSE INDICATOR

TP1496

Figure 1-1. ARC Type CD-3 Course Director, Major Units

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

This instruction book contains installation, operation, and maintenance information for the ARC Type CD-3 Course Director, manufactured by Aircraft Radio Corporation, Boonton, New Jersey.

1-2. PURPOSE.

The Type CD-3 is an airborne, stabilized compass and steering data computer that expands the usefulness of the ARC Type 15( ) VHF Navigation Equipment and the ARC Type 21A Automatic Direction Finder. In combination with the Type 15( ) or Type 21A, or both, the Type CD-3 relieves the pilot of the mental calculations necessary to establish correct headings for precise localizer, VOR, or ADF approaches. In addition, this combination enables the pilot to perform highly accurate en route tracking using VOR or LF facilities.

Note

All references to ARC Type 15( ) VHF Navigation Equipment contained in this instruction book are applicable to Type 15C, 15D, 15E, or 15F, unless otherwise noted.

When the Type CD-3 is used without the Type 15( ) or the Type 21A, it provides accurate magnetic heading data without gyro resettings.

1-3. SPECIFICATIONS.

Input Power:	
CA-12A with Inverter A5:	1.0 ampere at 27.5 volts dc
CA-12A with Power Transformer A5:	0.07 ampere at 27.5 volts dc and 13 watts at 115 volts, 400 cps
Total Weight:	15.8 lb[1]
Associated Equipment:	ARC Type 15C, 15D, 15E, or 15F VHF Navigation Equipment ARC Type 21A Automatic Direction Finder
Certification:	FAA TSO C6c
Transistor Complement: [2]	2N586 Slaving output clamp 2N586 Slaving output clamp 2N1183A Gyro slaving output 2N1183A Gyro slaving output 2N270 Compass slaving signal amplifier 2N586 Slaving output driver 2N1183B 400-cps inverter oscillator 2N174 Power output 2N174 Power output

[1] Total weight includes weight of CA-12A with inverter A5, IN-14, and G-13A but not the interconnecting cable assemblies. If the IN-14 is installed as part of the ARC Type 15( ) VHF Navigation Equipment, subtract 3.4 lb. If the G-13A replaces a conventional directional gyro normally installed in the aircraft, subtract 3.6 lb. If power transformer A5 is used in place of inverter A5, subtract 0.9 lb.

[2] With the exception of two 1N90 crystal diodes located in the C-92A Control Unit, all transistors and crystal diodes are located in the CA-12A Computer Amplifier.

Diode Complement: [2]

1N537	Heading computer discriminator
1N537	Heading computer discriminator
651C5	Computer crosswind compensating Zener diode
651C5	Computer crosswind compensating Zener diode
1N536	Track bridge phase discriminator
1N536	Track bridge phase discriminator
1N537	800-cps full-wave rectifier
1N537	800-cps full-wave rectifier
1N90	VOR limiting diode
1N90	VOR limiting diode

1-4. UNITS AND ACCESSORIES.

The units and accessories necessary for a Type CD-3 installation are listed in Table 1-1. The major units are illustrated in Figure 1-1.

TABLE 1-1. UNITS AND ACCESSORIES

UNITS

Qty	Name	ARC Type No.	ARC Part No.	Over-all Dimensions (inches) Height	Width	Depth	Weight (lb)
1	Computer Amplifier	CA-12A	24800	6	2-1/2	12-1/2	[3]
1	Gyro Indicator	G-13A	24790	3-1/8 dia		8	3.6
1	Compass Transmitter	CT-11A	24940	3	5-1/2 dia		1.8
1	Control Unit	C-92A	24770	2-1/4 dia		5-5/16	0.7
1	Course Indicator	IN-14	18028	3-1/4	3-1/4	7-1/4	3.4
1	Slaving Meter	IN-15A	25440	1-1/4 dia		1-1/4	0.1
1	Mounting	M-41A	21790	3-7/8	3-7/32	13-1/2	1.4

ACCESSORIES

Qty	Name	ARC Part No.
1	Switch and Cable Assembly (Monitor)	20045
1	Connector Kit, consisting of:	22366
1	Connector	21983
1	Plate	22287
6	Sems, fillister head, 4-40 thread by 1/4-inch long	524-0016
2	Screw, machine, flat head, 6-32 thread by 5/16-inch long	146-0020
2	Stud, snapslide	22237
1	Connector	24959
1	Connector	20034
1	Connector	25084
1	Connector	14320
1	Power Transformer Kit [4]	25706
1	Inverter Kit [4]	25705
1	Installation Kit for CT-11A consisting of:	26970
1	Bracket, mounting	26860
1	Post, mounting	20278
1	Post, mounting	20279
1	Post, mounting	20280
2	Channel, mounting	20281
2	Channel, mounting	20282
22	Screw	8753-0032
4	Screw	8753-0048
6	Washer	1168
6	Washer	8483
1	Instruction Book	701-0105

[2] See footnote 2 on page 1.

[3] 4.8 lb with inverter kit installed; 3.9 lb with power transformer kit installed.

[4] Depending on the power available in the aircraft, either a Power Transformer Kit ARC-25706 or an Inverter Kit ARC-25705 may be supplied (refer to CA-12A Computer Amplifier in paragraph 1-6).

1-5. ACCESSORIES REQUIRED BUT NOT SUPPLIED.

For the most effective use, the Type CD-3 is intended to be operated with the Type 15( ) or the Type 21A, or both. If it is used without such equipment, its operational features are limited to providing accurate heading information. Interconnecting cable assemblies for the Type CD-3 are required but not supplied. These cable assemblies must be fabricated from individual wires (not supplied) and the connectors listed in Table 1-1. The wire sizes and connectors required for fabrication are shown in Figure 2-13. The actual length of the cables will depend on the location of the equipment in the aircraft.

1-6. DESCRIPTION OF UNITS.

CA-12A Computer Amplifier. The CA-12A is the major unit of the Type CD-3. It is used to slave the G-13A Gyro Indicator to agree with the CT-11A Compass Transmitter. Gyro slaving provides precise, stabilized heading information. The CA-12A also develops a heading deviation voltage which is a function of the difference between the aircraft heading and the desired heading set into the IN-14 Course Indicator. When the Type CD-3 is used with the Type 15( ) the heading deviation voltage is combined with a d-c output voltage from the Type 15( ). When the Type CD-3 is used with the Type 21A the heading deviation voltage is combined with a d-c voltage developed by the CA-12A from an a-c voltage obtained from the Type 21A. In either case, the resultant voltage provides a visual indication by deflecting the IN-14 vertical pointer. When the aircraft is flown to center the vertical pointer the aircraft will be on an optimum heading to intercept and maintain a desired heading.

Physically, the CA-12A consists of five plug-in modules which are supported and interconnected by a main chassis. The main chassis consists of an aluminum-alloy frame to which the front panel, a printed-circuit connector board, and a connector assembly are attached. All connections, parts, and wiring common to the plug-in modules are also located on the main chassis. The front panel supports a handle and a mounting bracket. The printed-circuit connector board has five rows of gold-plated banana plugs which mate with jacks mounted on the edges of the five modules. Five metal studs are mounted on the outer surface of the connector board. These studs prevent accidental short circuits between the printed wiring and the dust cover. All modules consist of a printed-circuit board and an aluminum-alloy frame. The board and the frame provide a mount for the modular parts. Slots in the sides of the main chassis permit the use of a screwdriver to pry each module from the main chassis. Keyways in the sides of each module are used to guide the module into the main chassis. Each module is secured to the main chassis by two flat head screws.

Two optional A5 modules are available for use in the CA-12A. In aircraft that have a 115-volt, 400-cps voltage source, a power transformer module A5 is used. In aircraft that do not have a 115-volt, 400-cps voltage source, an inverter module A5 is used.

Input and output connections to the CA-12A are made through a single connector mounted on the rear of the main chassis.

G-13A Gyro Indicator. The G-13A is designed to replace the conventional vacuum-operated directional gyro normally installed in the aircraft. A slaving feature eliminates the need for periodic resetting of the G-13A to keep it in agreement with the magnetic compass. The unit thus combines the short-term stability of the gyro with the long-term stability of the magnetic compass.

The G-13A is slaved by the action of the slaving torque motor (precession coil). The gyro torque motor consists of a coil mounted on the gyro indicator case and a permanent magnet mounted on the inner gimbal. When excited by a direct current from the compass amplifier, the coil generates a magnetic field that is linked with the magnetic field of the permanent magnet. The torque produced on the magnet forces the gyro to precess about its vertical axis. This operation slaves the gyro indicator to the compass transmitter at the rate of 2° per minute.

A rotating circular dial, visible through a transparent circular window in the front of the indicator case, provides the pilot with magnetic heading information. The dial is graduated at 2° intervals throughout 360°. Major graduations are inscribed at 10° intervals. Legible numerals, with the last digit omitted, are inscribed every 30°. The four cardinal points are designated by the letters N, S, E, and W. The heading of the aircraft is indicated by a lubber line and also by an aircraft silhouette inscribed on the transparent face of the indicator. The transparent face also includes markers that indicate relative bearings of 45, 90, 180, 270, and 315° from the lubber line.

A caging knob is located on the front of the indicator. By depressing the caging knob, both the instrument dial and the directional mechanism are engaged. This feature permits the gyro element to be set manually to any desired heading. When the caging knob is released, the gyro element automatically becomes uncaged.

When power to the gyro indicator fails, a red fluorescent background is visible through the power failure indicator window. The window is located in the lower right portion of the indicator face. When power is restored, a solenoid is energized causing the red background to withdraw.

The gyro indicator may be powered by either a 115-volt, three-phase, 400-cps supply or by a 115-volt, single-phase, 400-cps supply. If the single-phase supply is used, a phase-splitting capacitor mounted in the CA-12A Computer Amplifier must be connected into the circuit. Input and output connections to the G-13A are made through a connector on the rear of the case.

CT-11A Compass Transmitter. The CT-11A is a remote compass transmitter that consists of three major elements: a magnet assembly, a coil assembly, and a magnetic compensator. The magnet assembly consists of two parallel bar magnets mounted on a pivoted cylindrical float. The float is enclosed in a liquid-filled chamber that allows expansion and contraction of the liquid with changes in temperature. This arrangement permits the magnet to align itself with the direction of the earth's magnetic field.

The coil assembly consists of a primary and secondary winding surrounding an annular core. The assembly is secured to the transmitter case directly above the float. In this position, the primary and secondary windings of the coil are linked by a portion of the permanent-magnet field. The primary winding, which is wound next to the core, is excited with a 26-volt, single-phase, 400-cps voltage from the computer amplifier. This voltage periodically saturates the core and creates a magnetic flux pattern that varies at twice the frequency (800 cps) of the excitation voltage. The flux linkage from the permanent-magnet field alters the 800-cps field that is set up across the core. The resultant flux induces a second-harmonic voltage in the secondary winding which surrounds the primary. The secondary winding is arranged in three sections, 120 electrical degrees apart, to provide a coil output voltage having the form of an 800-cps, Y-connected, synchro-type signal. This signal is a function of the magnetic heading of the aircraft.

The magnetic compensator, consisting of two sets of compensating magnets, is used to compensate for the effect of stray magnetic fields on the magnetic element. Both sets of magnets are symmetrically positioned with respect to the magnetic element and are arranged so that the resulting compensation is zero when the index marks associated with each set are in alignment. Each set can be adjusted by adjusting screws located outside the compensator plate and identified by the letters N-S and E-W. The range of adjustment on N-S and E-W headings is 15 degrees. Input and output connections to the CT-11A are made through a connector on the rear of the case.

C-92A Control Unit. The C-92A is an internally illuminated unit used for selecting the mode of operation of the Type CD-3. A six-position, four-section, rotary selector switch provides positions for course director operation using VOR, localizer, or ADF information. In addition, positions are available for use of VOR, localizer, ADF, or magnetic heading information alone. All information is displayed on the IN-14 Course Indicator. A NORM-REV switch, on the front of the C-92A, is used to reverse the polarity of the IN-14 vertical pointer circuit to permit flying toward the pointer at all times. A diode limiter is included to limit the d-c voltage output of the associated Type 15( ) and Type 21A when necessary. Input and output connections to the C-92A are made through a connector mounted on the rear of the unit.

IN-14 Course Indicator. The IN-14 is a combined deviation indicator and course selector to-from instrument. The deviation indicator of the IN-14 is a special type of microammeter with two pointers, and with two flags for indicating the operating or nonoperating condition of the pointers. The vertical pointer is used with the Type CD-3 and with the associated Type 15( ). The vertical pointer is pivoted at the top and moves from left to right to supply steering information during course director or magnetic heading operation, and track displacement information during VOR, localizer, or ADF operation. The horizontal pointer, which is pivoted at the left and moves up and down, is used with a glide slope receiver. The course selector dial is graduated in a compass scale of 360° and permits the selection of any desired VOR or ADF course by adjustment of the course selector knob. Simultaneous heading information is provided to the CA-12A by this operation.

IN-15A Slaving Meter. The IN-15A is a zero-center (10-0-10) voltmeter used to monitor the gyro slaving current. The slaving meter is mounted in a 1-inch diameter hole in the aircraft instrument panel.

M-41A Mounting. The M-41A is used to individually shock-mount the CA-12A. The CA-12A is secured to the M-41A by an adjustable clamp at the front of the M-41A rack. Connections between the CA-12A and the M-41A are made through mating panel connectors. Two flexible metal straps on the underside of the M-41A are used to ground the CA-12A and M-41A to the aircraft. Eight No. 8 screw holes are provided in the M-41A for securing the mounting.

Note

The CA-12A may be mounted with other ARC modular units using the appropriate ARC Series 40 Mounting and connector kits.

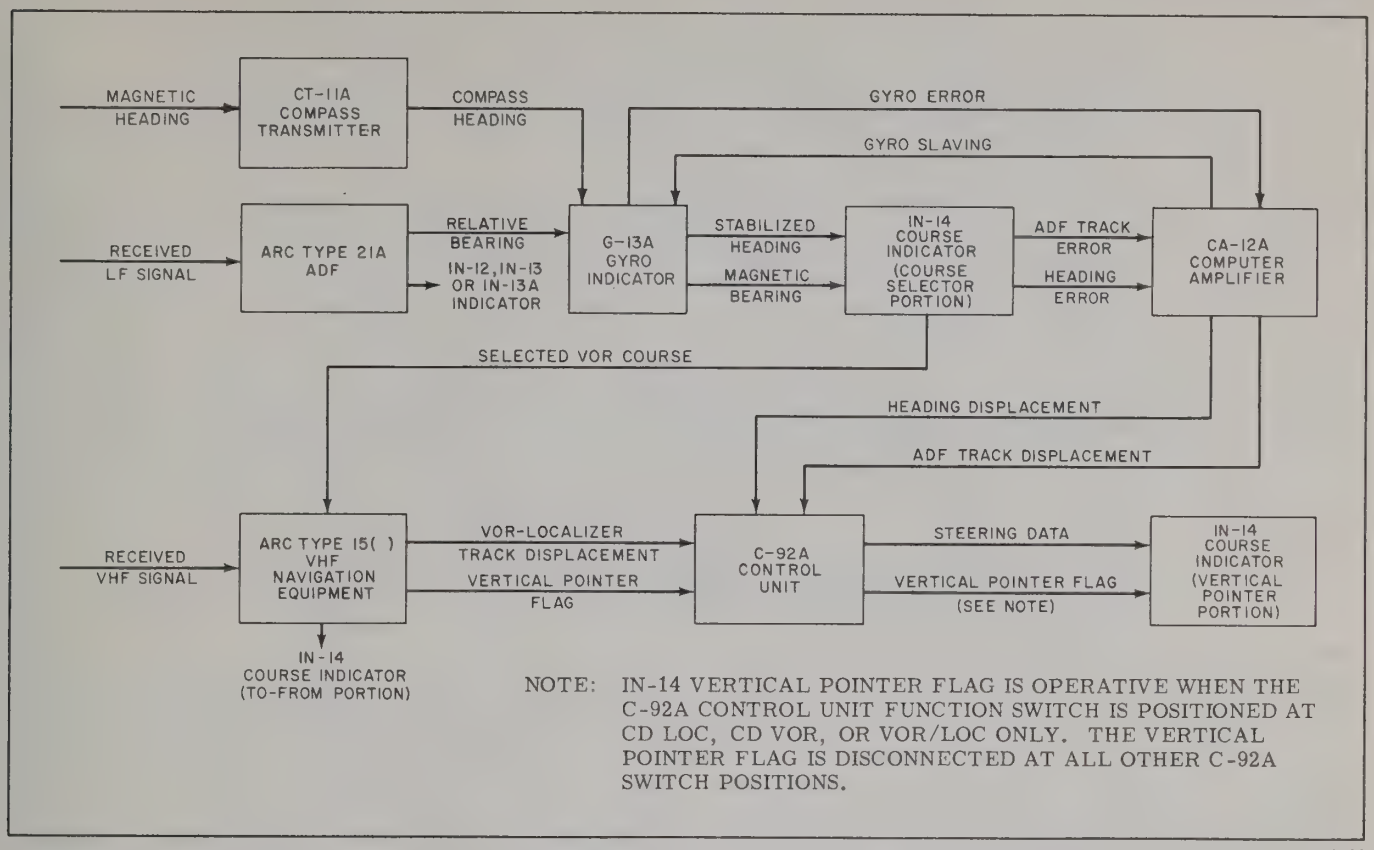

MAGNETIC HEADING
CT-11A COMPASS TRANSMITTER
COMPASS HEADING
GYRO ERROR
GYRO SLAVING
RECEIVED LF SIGNAL
ARC TYPE 21A ADF
RELATIVE BEARING
IN-12, IN-13 OR IN-13A INDICATOR
G-13A GYRO INDICATOR
STABILIZED HEADING
MAGNETIC BEARING
IN-14 COURSE INDICATOR (COURSE SELECTOR PORTION)
ADF TRACK ERROR
HEADING ERROR
CA-12A COMPUTER AMPLIFIER
SELECTED VOR COURSE
HEADING DISPLACEMENT
ADF TRACK DISPLACEMENT
RECEIVED VHF SIGNAL
ARC TYPE 15( ) VHF NAVIGATION EQUIPMENT
VOR-LOCALIZER TRACK DISPLACEMENT
VERTICAL POINTER FLAG
C-92A CONTROL UNIT
STEERING DATA
VERTICAL POINTER FLAG (SEE NOTE)
IN-14 COURSE INDICATOR (VERTICAL POINTER PORTION)
IN-14 COURSE INDICATOR (TO-FROM PORTION)
NOTE: IN-14 VERTICAL POINTER FLAG IS OPERATIVE WHEN THE C-92A CONTROL UNIT FUNCTION SWITCH IS POSITIONED AT CD LOC, CD VOR, OR VOR/LOC ONLY. THE VERTICAL POINTER FLAG IS DISCONNECTED AT ALL OTHER C-92A SWITCH POSITIONS.

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Figure 1-2. Type CD-3 with ARC Type 15( ) VHF Navigation Equipment and ARC Type 21A ADF, Block Diagram

Monitor Switch and Cable Assembly ARC-20045. The monitor switch and cable assembly consists of two spdt push-button Micro Switches wired in parallel and a three-conductor retracting cable. The monitor switch is used to momentarily remove heading information from the IN-14. The displacement of the aircraft from the desired course is then indicated by the position of the IN-14 vertical pointer. The retracting cable is used to connect the monitor switch to the C-92A.

1-7. BASIC PRINCIPLES OF OPERATION.

Introduction. Figure 1-2 is a block diagram of the Type CD-3 as used with the Type 15( ) and the Type 21A. The system provides precise stabilized magnetic heading information, combines this heading information with bearing data supplied by VOR, localizer, or LF ground facilities, computes an optimum heading for the selected course, and displays the computed steering information visually. To accomplish these functions, four characteristics are incorporated:

1. The G-13A Gyro Indicator is slaved to the CT-11A Compass Transmitter, combining the short-term stability of the gyro with the long-term stability of the magnetic compass. This combination provides continuous precise magnetic heading information to the pilot.

2. A heading deviation voltage is produced by the CA-12A Computer Amplifier. This voltage is a function of the angular difference between the aircraft heading and the selected course set into the IN-14 Course Indicator.

3. A course deviation voltage is obtained from the Type 15( ) or is developed by the Type CD-3 from relative bearing information from the Type 21A. In either case, this voltage is a function of the displacement of the aircraft from the selected course.

4. Automatic adjustment of the angular rates of change of these voltages is provided, so that when the two voltages are bucked in the IN-14 vertical pointer circuit and the aircraft is flown to center the vertical pointer, an optimum "cut" to the selected course will be established. The rate of change of the two voltages is controlled as follows:

a. The course deviation voltage is limited at aircraft position errors in excess of approximately 45°, in order that the heading deviation voltage may cancel it without requiring excessive heading deviation. This limiting level controls the initial angle of a "cut" taken at the selected course when the aircraft is positioned far off course.

b. The rate of change of the heading deviation voltage with respect to the heading error is small for heading deviations less than 20°. The heading deviation voltage at 20° is about equal to the course deviation voltage at 1° of course deviation. This relationship permits maintaining crab angles up to 20° while flying a course within 1° of the center of the selected course.

c. The rate of change of the heading deviation voltage with respect to the heading error is quite large at heading deviations in excess of 20°. Thus, for positions well off-course, the heading voltage takes control and assures a reasonable "cut" at the selected course.

d. At angles less than 20°, the same large rate of change of the heading deviation voltage is available for momentary heading changes. This relationship permits the pilot to quickly recognize and correct for heading changes caused by sudden wind gusts.

Magnetic Heading. When the C-92A Control Unit function switch is positioned at MAG HDG, all VOR, localizer, and LF signals are disconnected from the IN-14 vertical pointer circuit. In this position, the Type CD-3 compares the selected heading set into the IN-14 with the heading of the aircraft. If the two are in agreement, no current will flow in the vertical pointer circuit and the pointer will remain centered. If the selected course and the aircraft heading are different, current will flow in the vertical pointer circuit and the pointer will deflect in the direction of the selected heading.

VOR-Localizer. When the C-92A function switch is positioned at CD VOR or CD LOC, the Type 15( ) supplies course deviation information to the IN-14 vertical pointer. The heading signal, which is a function of the angle between the selected course and the aircraft heading, is modified by the CA-12A and then combined with the course deviation information. The resultant steering data is visually presented by the IN-14 vertical pointer. This indication corresponds to the optimum heading required to intercept and maintain the selected course.

Automatic Direction Finder. When the C-92A function switch is positioned at CD ADF, the Type CD-3 uses the Type 21A to supply bearing data in place of course deviation information supplied by the Type 15( ) by using the relationship: magnetic heading + relative bearing = magnetic bearing. The magnetic heading information is supplied by the slaved gyro feature of the Type CD-3. Relative bearing is provided by the ADF loop and is equal to the deflection of the ADF pointer from the nose of the aircraft. By means of a synchro system, the two signals are added algebraically to provide a signal which is a function of the magnetic bearing of the aircraft from the station. This magnetic bearing signal is then compared with the course selected by the IN-14. The resultant ADF track displacement is compared with heading displacement to provide steering data which is visually presented by the IN-14 vertical pointer. This indication corresponds to the optimum heading required to intercept and maintain the selected course.

SECTION II

INSTALLATION

2-1. UNPACKING.

Remove all packing material from the packing case and carefully remove the equipment. Inspect each unit for possible damage incurred during shipment. Be sure the operating controls on the units work properly. Check the units and accessories against the packing slip to be sure all items have been received and removed from the packing case.

> Caution
> Use extreme care when handling the G-13A Gyro Indicator. Always place the unit on a cushion or pad while it is out of its carton.

2-2. INSTALLATION CONSIDERATIONS.

The following requirements are applicable to all installations of the CD-3:

Unit dimensions and available installation area. Outline and installation dimensions for the units of the Type CD-3 are shown in Figures 2-1 through 2-12. Compare the space requirements for each unit with the area being considered. Locate the units so that they are accessible for inspection and maintenance and are in an area free from excessive vibration and heat.

Location of G-13A. The G-13A should be installed on a shock-mounted instrument panel within reach and reading distance of the pilot. The panel should be vertical when the aircraft is in a level-flight position. The G-13A should be mounted so that its lateral axis is parallel to the lateral axis of the aircraft. If necessary, the unit may be mounted on a panel having a slope up to 10° from normal. Such an installation will cause a decrease in system accuracy of approximately 1/2°.

Location of CT-11A. The CT-11A should be installed in the rear of the fuselage or in the outer wing panel. Do not mount the CT-11A near electrical circuits, electrical devices, movable magnetic masses, or in any location, particularly cargo spaces, where there is a possibility of a varying magnetic field. Compensation can be made for fixed magnetic deviation but not for varying magnetic fields. Do not run a single-wire lead anywhere near the CT-11A.

To determine the best location for the CT-11A, use a direct-reading compass without compensating magnets. Position the aircraft (with main engines and all electrical apparatus in operation) on a magnetic heading at each of the four cardinal compass points, noting the deviation at each point. At each point move the flight controls and associated equipment and note the effect on the test compass. Repeat this procedure at several locations. Select the position in the aircraft where the minimum average deviation occurs. The CT-11A should be mounted in this position. For installation, use only nonmagnetic materials. In general, the requirements for locating the CT-11A in the aircraft are identical to those of similar magnetic compass systems.

Location of IN-14 and C-92A. The IN-14 and C-92A should be mounted within convenient view and reach of the operator. The instrument panel is preferable, but if space is not available, another location may be used.

Location of IN-15A. The IN-15A should be mounted on the main instrument panel as near as possible to the G-13A.

Location of CA-12A. The CA-12A is shock-mounted on the M-41A or other ARC Series 40 Mounting. It may be installed in any convenient location in the aircraft. Allow sufficient clearance (at least 1/2 inch) on all sides for shock-mount travel and ventilation, and sufficient space in front to permit easy removal from its mounting. The cable connections should be arranged so as not to restrict shock-mount travel.

Location of monitor switch. The monitor switch of Monitor Switch and Cable Assembly ARC-20045 should be mounted on a bracket, preferably on the left side of the control wheel. The monitor switch is connected to the C-92A through the cable provided.

Circuit Protection. The primary d-c power to the Type CD-3 should be connected through a 5-ampere circuit breaker switch located within reach of the operator (the circuit-breaker switch is not supplied with the Type CD-3).

2-3. INSTALLATION OF A5 MODULE.

The CA-12A Computer Amplifier is normally supplied without an A5 module. Depending on the power available in the aircraft, either a power transformer kit or an inverter kit should be installed. Power Transformer Kit ARC-25706 is used when a source of 115-volt 400-cps power is available in the aircraft. This kit consists of a power transformer module A5, two flat head screws used to secure the module to the CA-12A frame, a nameplate, and two self-tapping screws used to fasten the nameplate to the front panel of the CA-12A. To install the power transformer kit, slide the module into the place provided in the CA-12A until the pins on the printed-circuit board fully engage the jacks on the edge of the module printed-circuit board. Secure the module to the chassis with two flat head screws provided. Fasten the nameplate to the front panel of the CA-12A by inserting the self-tapping screws in the holes provided.

Inverter Kit ARC-25705 is used when a source of 115-volt 400-cps power is not available in the aircraft. This kit consists of an inverter module A5, two flat head screws used to secure the module to the CA-12A frame, a transistor assembly, a nameplate, and two self-tapping screws used to fasten the nameplate to the front panel of the CA-12A. To install the inverter kit, proceed as follows:

Step 1. Remove the dust cover from the CA-12A. Detach the four mounting screws and lift the cover plate from the CA-12A chassis. (The cover plate is located adjacent to the connector.)

Step 2. Disassemble the transistor assembly by removing the six fillister head screws, attaching hardware, and two brass nuts used to secure the transistors. Note that one of the plates used to mount the transistors is finished with gray wrinkle paint on one side.

Step 3. Place the painted side of the plate on the outside of the CA-12A chassis, aligning the holes in the plate with the holes punched in the chassis. Position the remaining plate on the inside of the chassis, aligning its holes with the holes in the chassis and the painted plate. Fasten the plates to the chassis using the hardware previously removed.

Step 4. Guide the yellow and green wire of each transistor through the holes provided in the chassis and mounted plates. Fasten each transistor in place by attaching a brass nut to its threaded terminal. Solder the wires attached to the transistors to the four terminals on the main printed-circuit board, following the wiring information shown in Figure 5-2.

Step 5. Slide the inverter module into the place provided in the CA-12A until the pins on the printed-circuit board fully engage the jacks on the edge of the module printed-circuit board. Secure the module to the chassis with the two flat head screws provided.

Step 6. Fasten the nameplate to the front panel of the CA-12A by inserting the self-tapping screws in the holes provided. Replace the CA-12A dust cover.

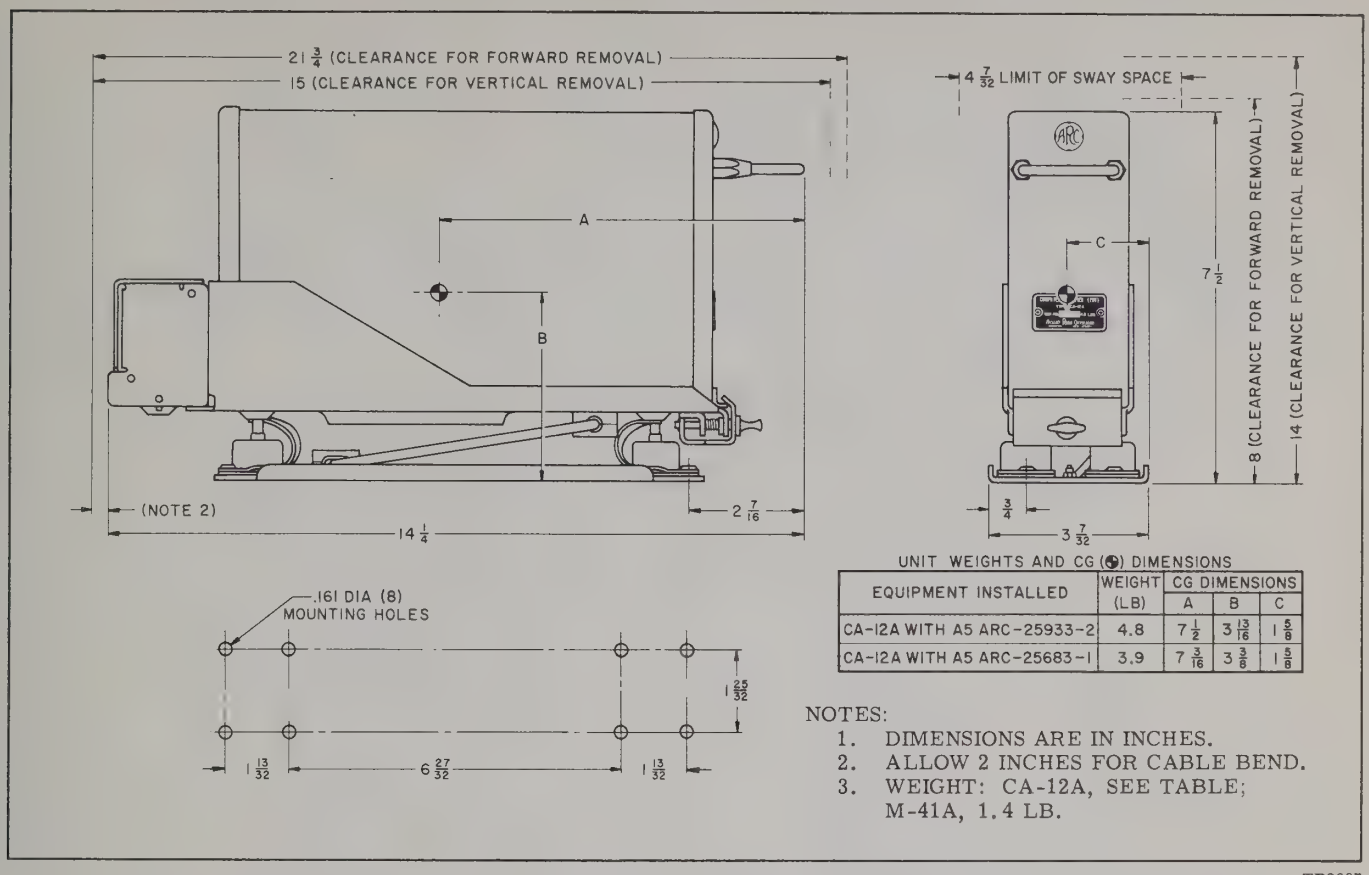
2-4. INSTALLATION OF UNITS.

CA-12A and M-41A. The CA-12A Computer Amplifier is designed for individual installation on an M-41A Mounting or with other ARC modular units on an ARC Series 40 multiple-unit mounting. Installation dimensions for the CA-12A installed on an M-41A are shown in Figure 2-1. External wiring to the CA-12A is accomplished with the ARC-21983 Connector. This connector with the necessary parts and attaching hardware is part of Connector Kit ARC-22366. As shipped, the connector contacts are separate from the body of the connector. Wire the connector and mount the M-41A and CA-12A as follows:

Step 1. Drill the aircraft mounting surface for eight No. 8 binding head screws, located as shown in Figure 2-1.

Note

The bottom plate of the M-41A can be used as a template for locating the mounting holes.



UNIT WEIGHTS AND CG (⊕) DIMENSIONS

EQUIPMENT INSTALLED	WEIGHT (LB)	CG DIMENSIONS		
		A	B	C
CA-12A WITH A5 ARC-25933-2	4.8	7 1/2	3 13/16	1 5/8
CA-12A WITH A5 ARC-25683-1	3.9	7 3/16	3 3/8	1 5/8

NOTES:
1. DIMENSIONS ARE IN INCHES.
2. ALLOW 2 INCHES FOR CABLE BEND.
3. WEIGHT: CA-12A, SEE TABLE; M-41A, 1.4 LB.

TP2097

Figure 2-1. CA-12A Computer Amplifier with M-41A Mounting, Installation Dimensions

Step 2. Insert the screws through the eyelets attaching the shock mounts to the lower plate, and place the M-41A in position. Secure with nuts and lockwashers. The mounting surface should be clean, bare metal to insure adequate grounding of the unit.

Step 3. Remove the coupling box from the rack assembly and then remove the top cover from the coupling box.

Step 4. Using the six ARC-524-0016 fillister head Sems screws furnished, attach the ARC-21983 Connector to the ARC-22287 Plate as shown in Figure 2-2.

Step 5. Cut the wires necessary to form the interconnecting cable. The length of the wires depends on the type of aircraft and the proposed location of the unit. If possible, use color-coded wires to simplify future maintenance of the interconnected units.

Step 6. Remove the insulation from the ends of each wire and tin the bared ends.

Step 7. Solder connector contacts to the wires to be terminated in the connector (see Figure 2-13). Do not get solder on the outside of the contacts.

Note

Contacts in Connector Kit ARC-22366 are supplied loose. Contacts for holes designated with letters are larger than for those designated with numbers. To remove the contacts from the connector block, use Contact Removing Tools ARC-22001 and ARC-22002. If desired, the connector block may be used as a holding fixture by inserting the contacts part way before soldering wires to them.

Step 8. Loosen the two screws holding the cable clamp to the coupling box. Route the contacts and attached wires through the cable clamp and insert the contacts in the appropriate connector holes. Make sure that each contact is seated.

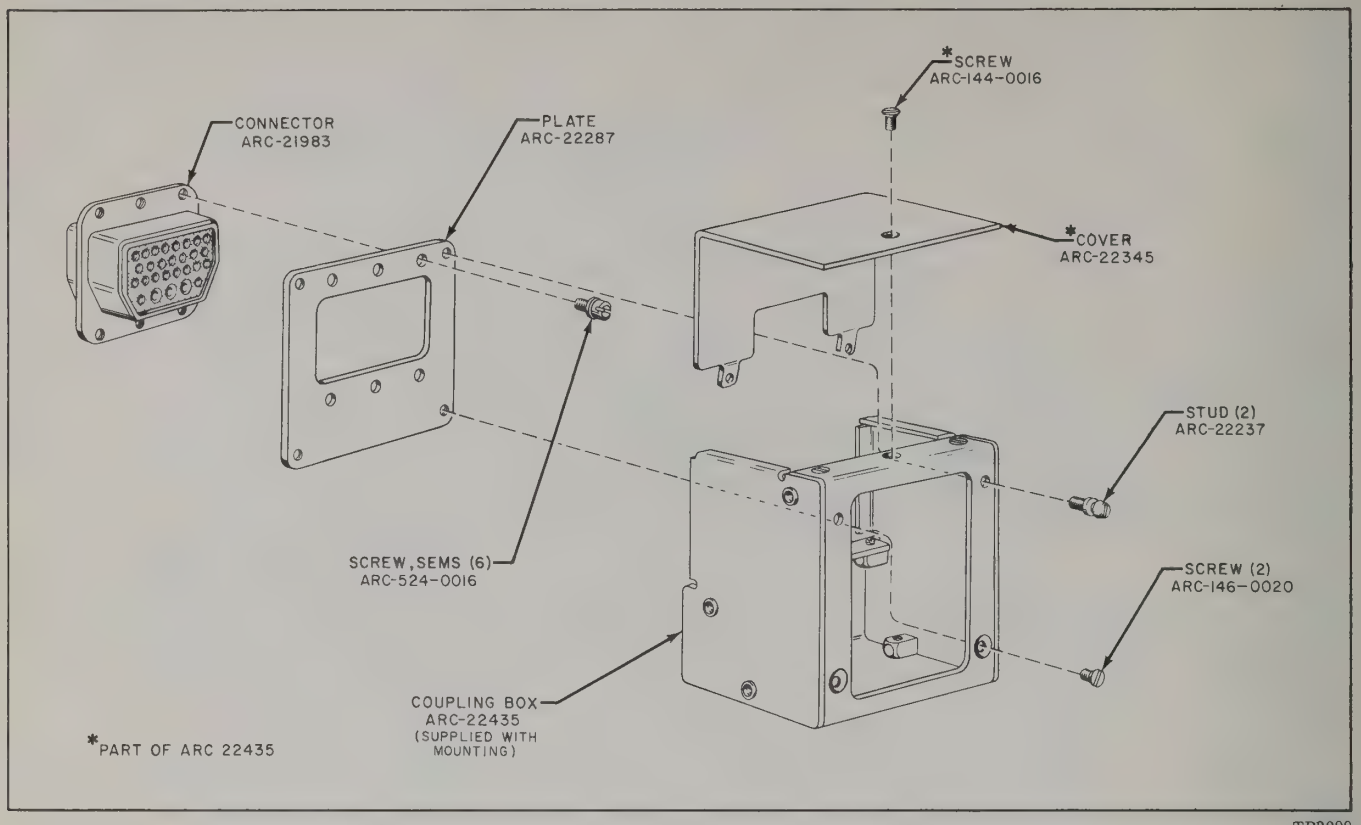


Figure 2-2. Assembly of Connector, Plate, and Coupling Box

Step 9. Arrange the wires allowing enough slack to prevent tension on the connector contacts when the cable clamp is tightened. Tighten the cable clamp and replace the top cover on the coupling box.

Step 10. Attach the two ARC-22237 snapslide studs to the coupling box as shown in Figure 2-2. Place the coupling box on the rear of the M-41A. Secure the coupling box by engaging the two snapslide fasteners on the M-41A with the snapslide studs on the coupling box.

Step 11. Loosen the thumbscrew on the front of the M-41A and slide the CA-12A in place so that the CA-12A connector fully engages the mating connector on the coupling box. Secure the CA-12A by engaging it with the clamp at the front of the tray and tightening the thumbscrew. Safety-wire the thumbscrew in position.

G-13A.

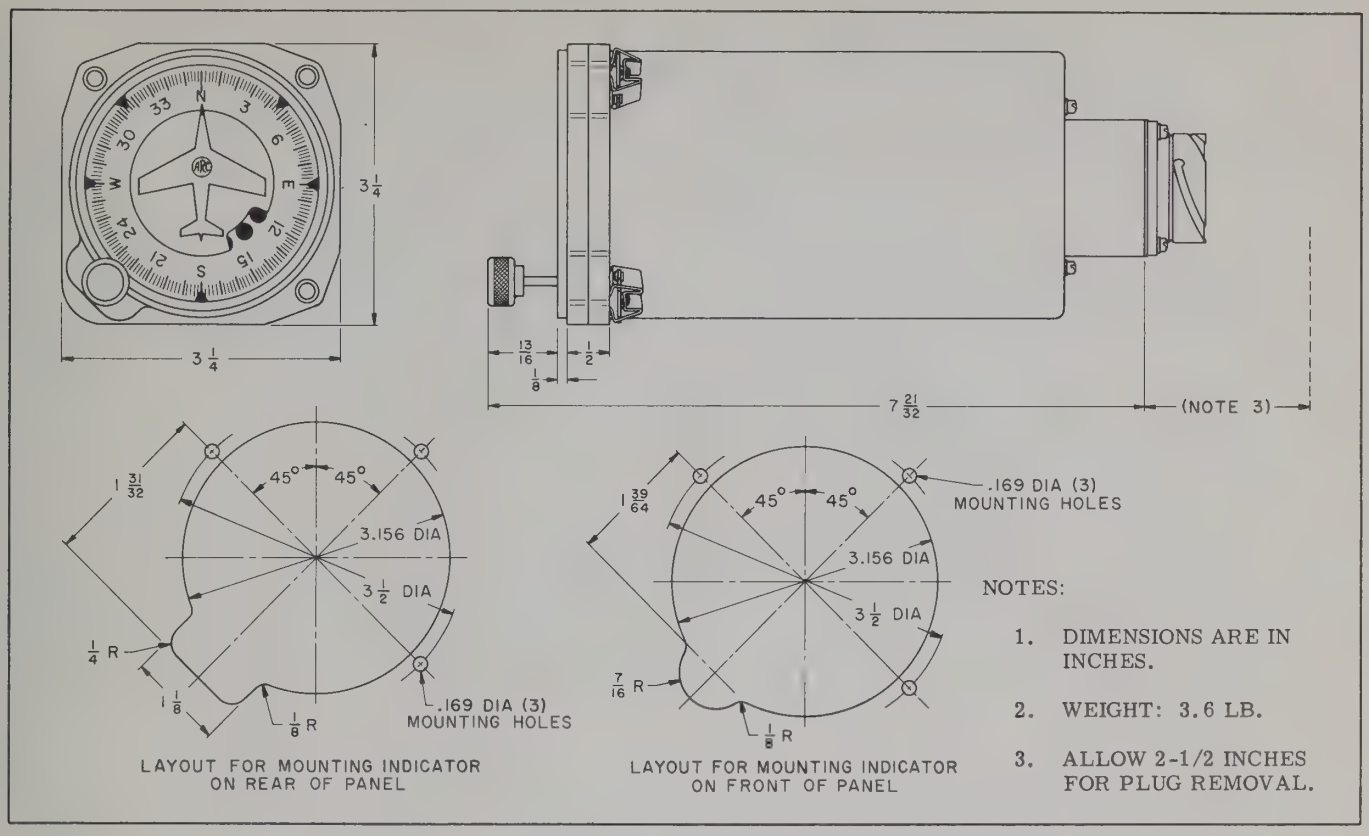
Installation dimensions for the G-13A Gyro Indicator are shown in Figure 2-3. The unit should be attached to the instrument panel with three No. 8-32 mounting screws. The length of the mounting screws should be 5/8 inch plus the panel thickness. Tinnerman-type locknuts, No. T250(8-32), may be used for either the front or the back of the panel mounting. All screws should be tightened securely.

Caution

Use extreme care when handling the G-13A Gyro Indicator. Always place the unit on a cushion or pad while it is out of its carton or off the instrument panel.

CT-11A. Outline dimensions for the CT-11A Compass Transmitter are shown in Figure 2-4. Depending on the type of aircraft, the CT-11A may be mounted either in the rear of the fuselage or in the outer wing panel. Installation Kit ARC-26970 is designed to facilitate mounting the CT-11A in either location. Since the installation kit contains parts for mounting the CT-11A in either the fuselage or the wing, neither installation will use all the parts contained in the kit. Specific instructions are given in the following paragraphs.

Fuselage mounting of CT-11A. Mounting bracket ARC-26860 (part of Installation Kit ARC-26970) provides a mount for the CT-11A. The supports necessary for the mounting bracket are not furnished with the installation kit and should be fabricated from available material to suit the individual installation requirements. Aluminum alloy 5052-H34 (formerly 52S-1/2H or 52S-H34), 0.064 inch thick, is recommended for fabrication



TP3001

Figure 2-3. G-13A Gyro Indicator, Installation Dimensions

of the supports. Figure 2-5 illustrates mounting bracket ARC-26860 fastened to a pair of typical supports. Figure 2-6 and 2-7 show location of the CT-11A and typical mounting methods in representative types of aircraft.

Wing mounting of CT-11A. Figure 2-8 illustrates a typical CT-11A wing installation. With the exception of the cover plate and Duralumin stiffener, all parts shown in the illustration are furnished with Installation Kit ARC-26970. To install the CT-11A in the aircraft wing, proceed as follows:

Step 1. Using nonmagnetic rivets, fasten Duralumin stiffener (0.040 inch thick) to the desired place on the aircraft wing. The size and shape of the stiffener depends upon the type of aircraft and the exact location of the CT-11A.

Step 2. Cut a 4-3/4-inch by 5-inch hole through the stiffener and the wing skin as shown in Figure 2-8.

Step 3. Using aluminum alloy 5052-H32 (formerly 52S-H32 or 52S-1/4H), 0.064 inch thick, fabricate a cover plate as shown in Figure 2-8.

Step 4. Using the cover plate as a template, and a No. 16 (0.177 inch) drill, drill 12 holes through the stiffener and wing skin as shown.

Step 5. Using mounting channels ARC-20281 and ARC-20282, positioned as shown, and a No. 39 (0.099 inch) drill, drill 8 holes through the stiffener and wing skin as illustrated. Fasten the mounting channels to the wing skin using nonmagnetic rivets.

Step 6. Scribe lines on the stiffener parallel to the fore and aft axis of the aircraft as shown in the illustration.

Step 7. Mount CT-11A on cover plate, using Mounting Posts ARC-20278, ARC-20279, and ARC-20280 as shown. Position cover plate with attached CT-11A in wing, with fore and aft marks on cover plate aligned with marks scribed on stiffener. Fasten assembly in place with 12 ARC-8753-0032 screws.

C-92A. Installation dimensions and assembly details for the C-92A Control Unit are shown in Figures 2-9 and 2-10. To install the C-92A, proceed as follows:

Step 1. Disassemble the C-92A as shown in Figure 2-10.

Step 2. Using the ARC-25039 Spacer as a template, drill the mounting panel as shown in Figure 2-9.

Step 3. When installing the C-92A on mounting panels less than 1/16 inch thick, mount the ARC-25039 Spacer as shown in Figure 2-10. On mounting panels thicker than 1/16 inch, discard the spacer.

Step 4. Pass the shaft end of the C-92A through the mounting panel. Align the guide pin with the 0.067-inch diameter hole and fasten the unit in place with the nut provided.

Step 5. Insert the base end of the three lamps into the 0.290-inch diameter holes. Insert one of three sleeves over each of the lamps. Press each sleeve until its flange rests on the front surface of the mounting panel.

Step 6. Align the guide pin with the mating hole in the front plate. Then install the front plate and fasten it in place with the three binding head screws.

Step 7. Place the lever and knob on the shaft and fasten them in place with the setscrews provided.

IN-14. If the Type CD-3 is installed in an aircraft that includes a Type 15( ), the IN-14 Course Indicator replaces the instrumentation normally supplied with this equipment. In this case, the IN-14 is mounted in the space vacated by the conventional deviation indicator. If the Type CD-3 and an ARC Type 15F VHF Navigation Equipment are to be installed in the aircraft simultaneously, install the IN-14 by referring to the installation dimensions shown in Figure 2-11. The IN-14 may be mounted either from the front or rear of the instrument panel, using three No. 8-32 screws.

IN-15A. The IN-15A Slaving Meter should be mounted close to the G-13A Gyro Indicator. Installation dimensions for the IN-15A are shown in Figure 2-12. The instrument is mounted from the front of the instrument panel in a 1-inch hole and secured at the rear with a knurled nut.

Monitor Switch. The monitor switch should be mounted on a bracket (not supplied with the Type CD-3), preferably on the left side of the control wheel.

2-5. INTERCONNECTION OF UNITS.

Wiring and interconnection of the units of the Type CD-3 with ARC Type 15F VHF Navigation Equipment and ARC Type 21A ADF are shown in Figure 2-13.

2-6. OPERATIONAL CHECK.

Step 1. Interconnect the Type CD-3 units, the Type 15( ), the Type 21A, and the primary power source.

Step 2. Turn on the primary power and allow a warmup period of about 3 minutes.

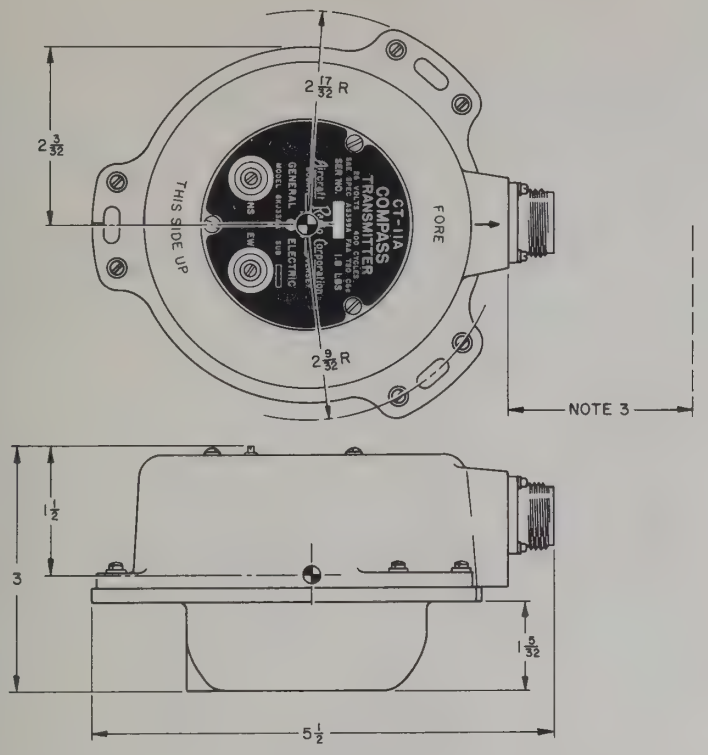
Note
It is not necessary to run the engine for the following checks.

Step 3. Cage the G-13A Gyro Indicator and rotate the caging knob to the heading indicated on the cockpit compass. Note the deflection of the IN-15A Slaving Meter needle. Turn the gyro caging knob so that the gyro card rotates in the direction the slaving meter needle is deflected. The needle should move to the center when the gyro is set to the correct heading; that is, when it is in agreement with the CT-11A Compass Transmitter.

Caution
Turning the caging knob so that the gyro card moves in an opposite direction will result in 180° ambiguity.

The slaving meter needle should move almost full scale when the gyro is rotated 1° in either direction from the setting that centers the needle.

Step 4. Set the slaved gyro to 0°. Set the C-92A function switch to MAG HDG. Set the IN-14 to 0°. The IN-14 vertical pointer should center.

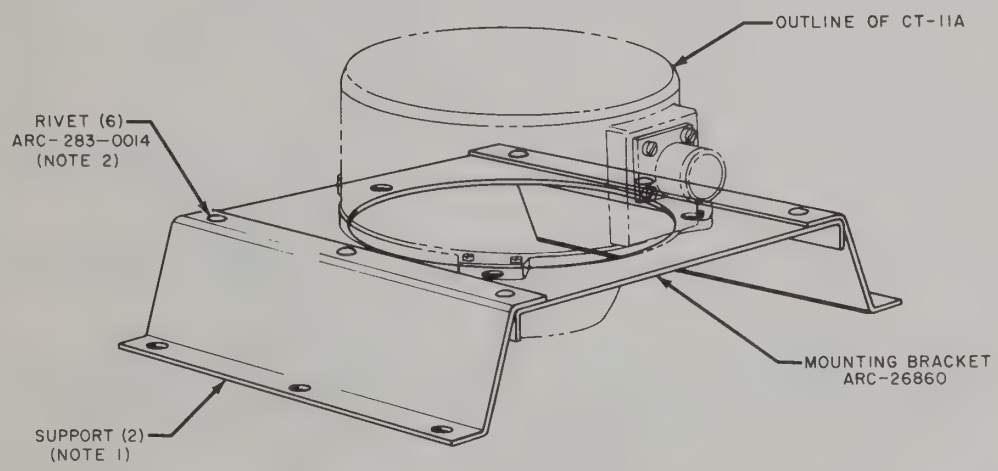


NOTES:

1. DIMENSIONS ARE IN INCHES.
2. WEIGHT: 1.8 LB.
3. ALLOW 3-1/2 INCHES FOR PLUG REMOVAL.

TP3003

Figure 2-4. CT-11A Compass Transmitter, Outline Dimensions



NOTES:

1. DESIGN SUPPORTS TO SUIT INSTALLATION REQUIREMENTS OF INDIVIDUAL AIRCRAFT. RECOMMENDED MATERIAL: 5052-H34 (FORMERLY 52S-1/2H OR 52S-H34) ALUMINUM 0.064-INCH THICK.
2. USING NONMAGNETIC RIVETS ARC-283-0014, RIVET SUPPORTS TO MOUNTING BRACKET.
3. MOUNTING BRACKET ARC-20071 IS FURNISHED AS PART OF INSTALLATION KIT ARC-26970.

TP3005

Figure 2-5. Mounting and Typical Supports for CT-11A Compass Transmitter

Step 5. Set the IN-14 to 10°. The IN-14 vertical pointer should move approximately one-half scale to the right. When the G-13A is set to 10°, the needle should return to the center.

Step 6. Place the C-92A function switch to VOR/LOC ONLY. In this position the localizer or VOR signal is presented by the IN-14 vertical pointer without the addition of the Course Director signal. Tune to a localizer or VOR station and check that the direction of the vertical pointer deflection is correct. An ARC Type H-14 or H-14A Signal Generator may be used instead of the station. This test is necessary to check the cable connections.

Step 7. Turn the Type 15( ) off. Set the C-92A function switch to CD LOC and the NORM-REV switch to NORM. Cage the G-13A and set it to 0°. Set the IN-14 to 0° and wait one minute.

Step 8. Quickly set the IN-14 to 10°. The IN-14 vertical pointer should move right, then slowly return almost to the center. This test checks the crosswind compensation provided by the Type CD-3.

2-7. COMPASS TRANSMITTER INDEX SETTING AND COMPENSATION.

General. Two types of errors may exist in a magnetic compass system; they are the base error and the harmonic error. The base error (called the index error in an operating system) is due to a misalignment of the compass with the aircraft. This error does not vary with the heading of the aircraft and may be removed by moving the compass transmitter in its mount. The harmonic error (called harmonic because of the similarity between the error curve and a sine wave) is due to electromagnetic and magnetic disturbances in the aircraft. This error varies with the heading of the aircraft and may be corrected by means of the magnetic compensator contained in the CT-11A Compass Transmitter.

After installing the CT-11A, the index setting and the need for compensation should be checked. Procedures for performing these checks and also for compensating the CT-11A are described in the following paragraphs.

Index Setting. Index setting of the CT-11A requires the use of either a sighting compass or a compass rose to determine the aircraft headings. The normal electrical load should be on when taking the readings. If a sighting compass is used, it should be supported by a nonmagnetic tripod or similar device at a minimum distance of 50 feet from the aircraft. To index the CT-11A and to check whether compensation is required, proceed as follows:

Step 1. Place the aircraft in level flight position, if possible. If a compass rose is used, position the aircraft on it. If a sighting compass is used, align the compass with the centerline of the aircraft. Turn on the normal electrical load.

Step 2. Check that the magnetic compensating assemblies in the CT-11A are in their approximate zero position as indicated by the markings on the N-S and E-W adjusting screws on the top of the unit. A zero condition exists when the index dot on the screw coincides with the index line on the side of the compensator plate.

Step 3. Turn on the Type CD-3 system and allow several minutes for the gyro to attain normal operating speed.

Step 4. Turn the aircraft to every 30° position up to 330°. (If the sight is taken facing aft, add or subtract 180° from the sighting compass reading.) At each of these headings, cage the G-13A and rotate the gyro caging knob until the IN-15A Slaving Meter centers. Record the gyro readings. Make certain that the G-13A is not set to a 180° error reading by checking the cockpit compass. If the engines are not running, it is advisable to tap the CT-11A, or the immediate area in which it is mounted, to obtain more accurate readings.

Step 5. Record the difference between the reading of the gyro and the heading of the aircraft as determined by the sighting compass or compass rose. Call the error "plus" if the reading of the gyro is greater than the heading of the aircraft and "minus" if it is less. After all readings have been taken, add the plus errors together and add the minus errors together. Subtract the smaller sum from the larger, and affix the sign of the larger. Divide this sum by 12. The result is the average error.

Step 6. To make the correction: Cage the G-13A and set to center the IN-15A. Record the gyro card reading. Turn the gyro slaving knob clockwise or counterclockwise, as required, the amount of the average error. Rotate the CT-11A in its mounting until the IN-15A is again centered. Tighten the retaining screws on the CT-11A.

Step 7. If the errors of the individual headings did not agree within approximately ±1°, perform the following compensation procedure.

Compensation. If magnetic compensation is required, proceed as follows:

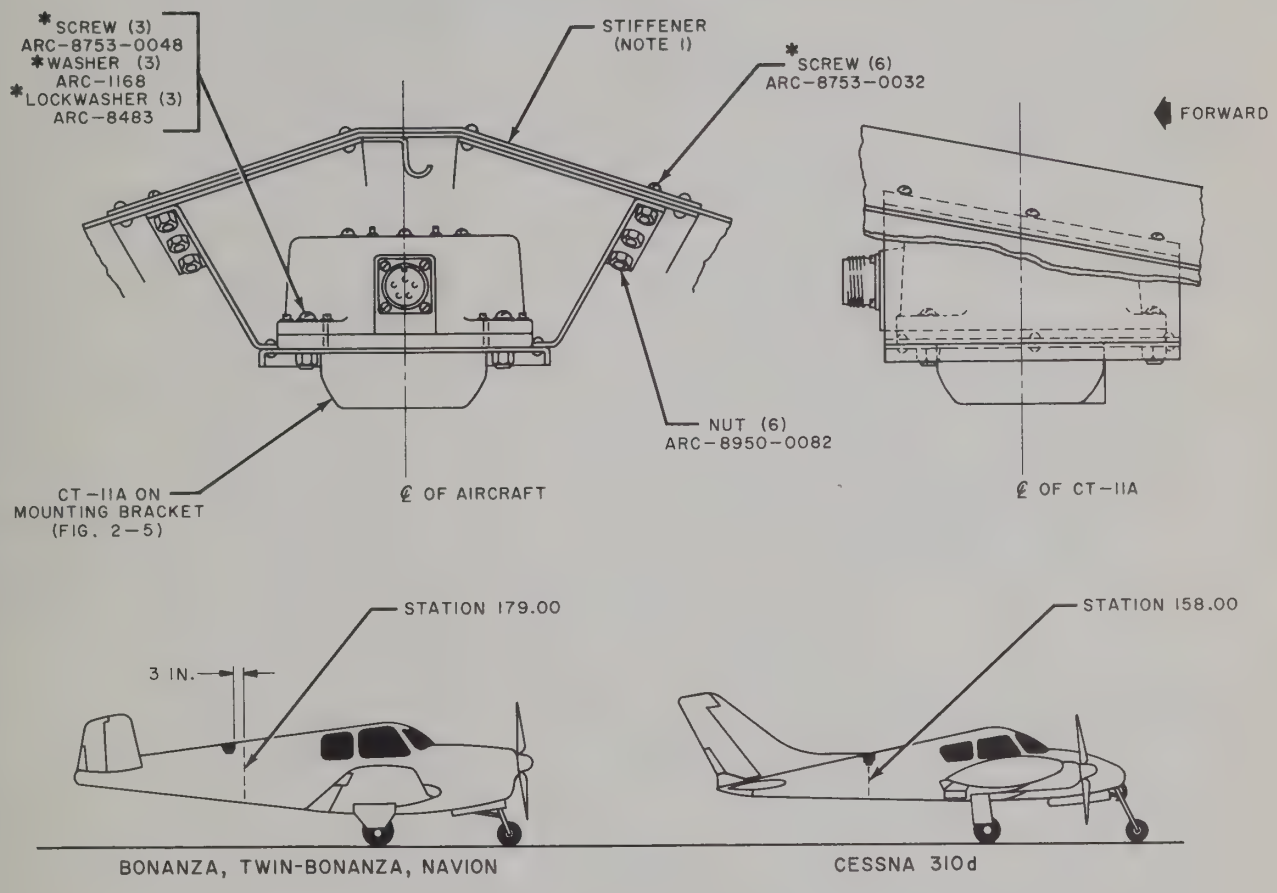
Step 1. Place the aircraft on a 0° heading and take out all the error by rotating the N-S adjusting screw.

Step 2. Place the aircraft on a 90° heading and take out all the error by rotating the E-W adjusting screw.

Step 3. Place the aircraft on a 180° heading and remove one-half the error by rotating the N-S adjusting screw.

Step 4. Place the aircraft on a 270° heading and remove one-half the error by rotating the E-W adjusting screw.

Step 5. Check the compensation by recording the errors on each 45° heading. Any error should be less than ±1°. If necessary, repeat the compensation procedure.

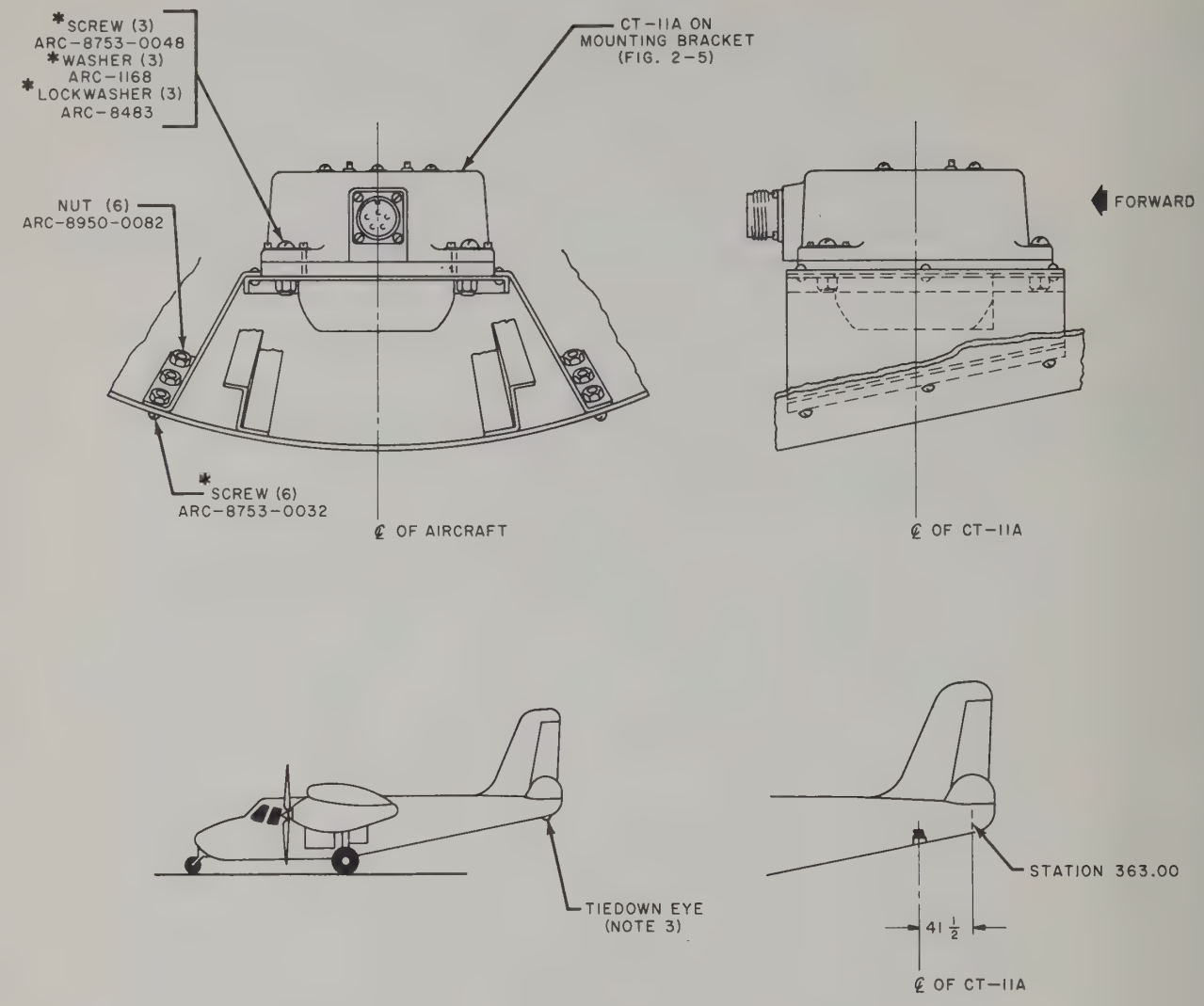


NOTES:

1. USING NONMAGNETIC RIVETS FASTEN DURAL STIFFENER (.040 INCH THICK) TO SKIN OF AIRCRAFT.
2. LEVEL CT-11A WITH AIRCRAFT IN LEVEL FLIGHT POSITION BY INSERTING ALUMINUM WASHERS BETWEEN CT-11A AND MOUNTING BRACKET AS REQUIRED.

TP3007

Figure 2-6. Installation of CT-11A Compass Transmitter in Cessna, Piper Apache, Bonanza, Twin-Bonanza, and Navion Aircraft



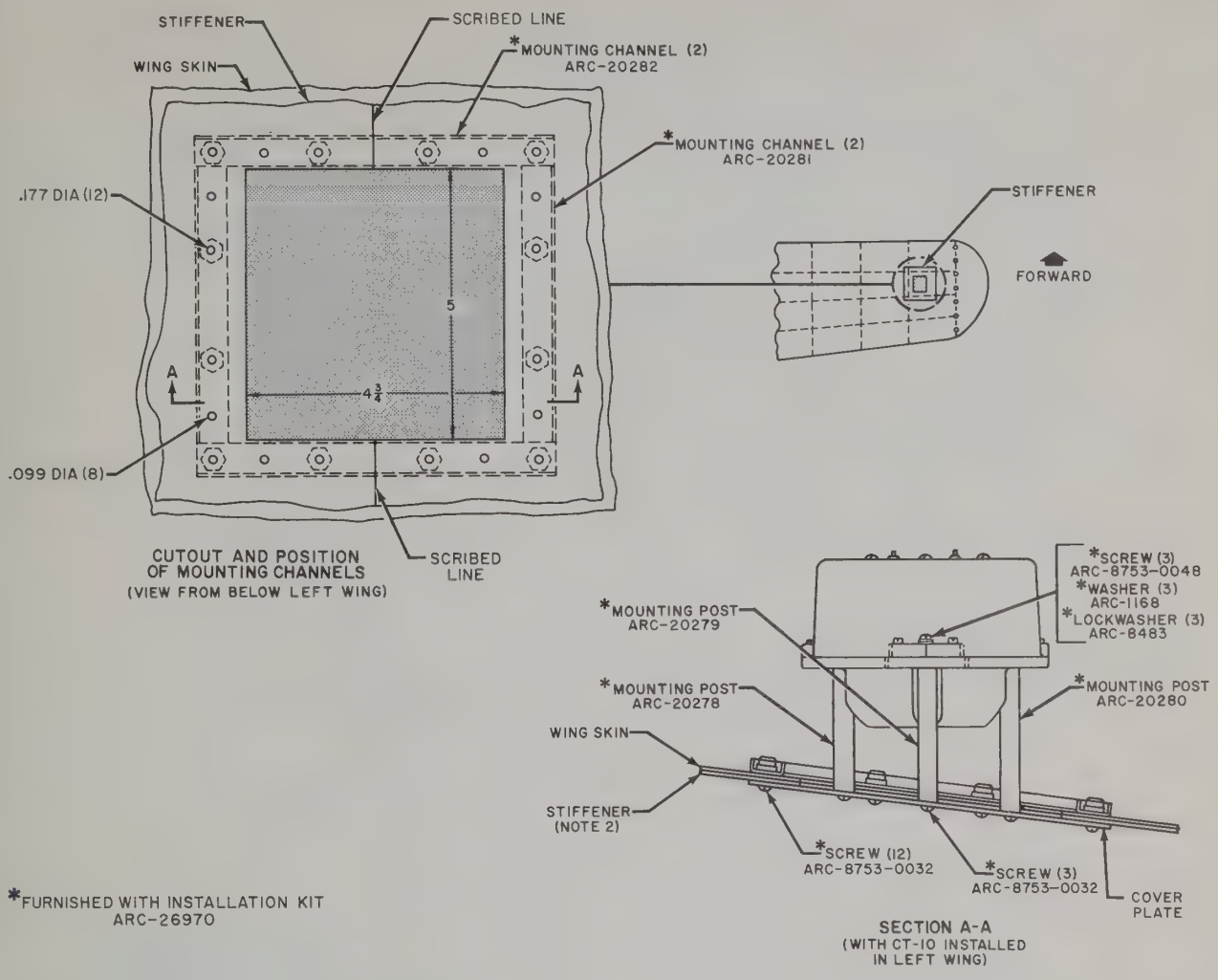
*PART OF INSTALLATION KIT ARC-26970

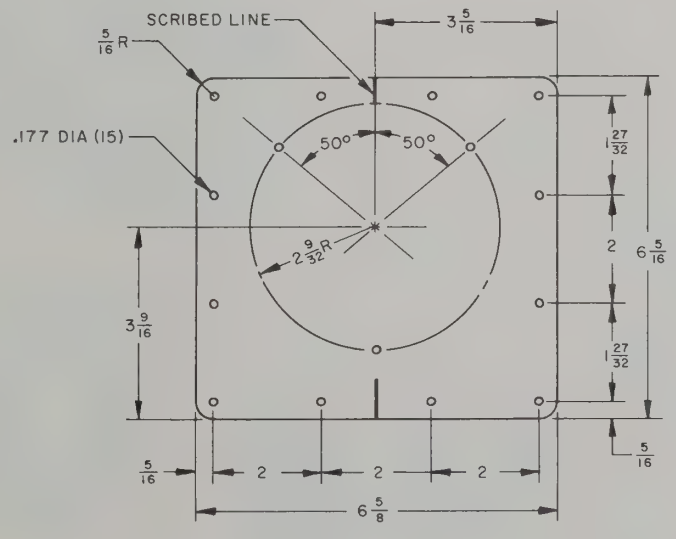
NOTES:

1. DIMENSIONS ARE IN INCHES.
2. LEVEL CT-11A WITH AIRCRAFT IN LEVEL FLIGHT POSITION BY INSERTING ALUMINUM WASHERS BETWEEN CT-11A AND MOUNTING BRACKET AS REQUIRED.
3. RUN STRING FROM FORWARD LOWER CENTERLINE OF FUSELAGE TO REAR TIEDOWN EYE TO USE AS REFERENCE IN ALIGNING COMPASS MOUNT.

TP3009

Figure 2-7. Installation of CT-11A Compass Transmitter in Aero Commander 520 and 560 Aircraft

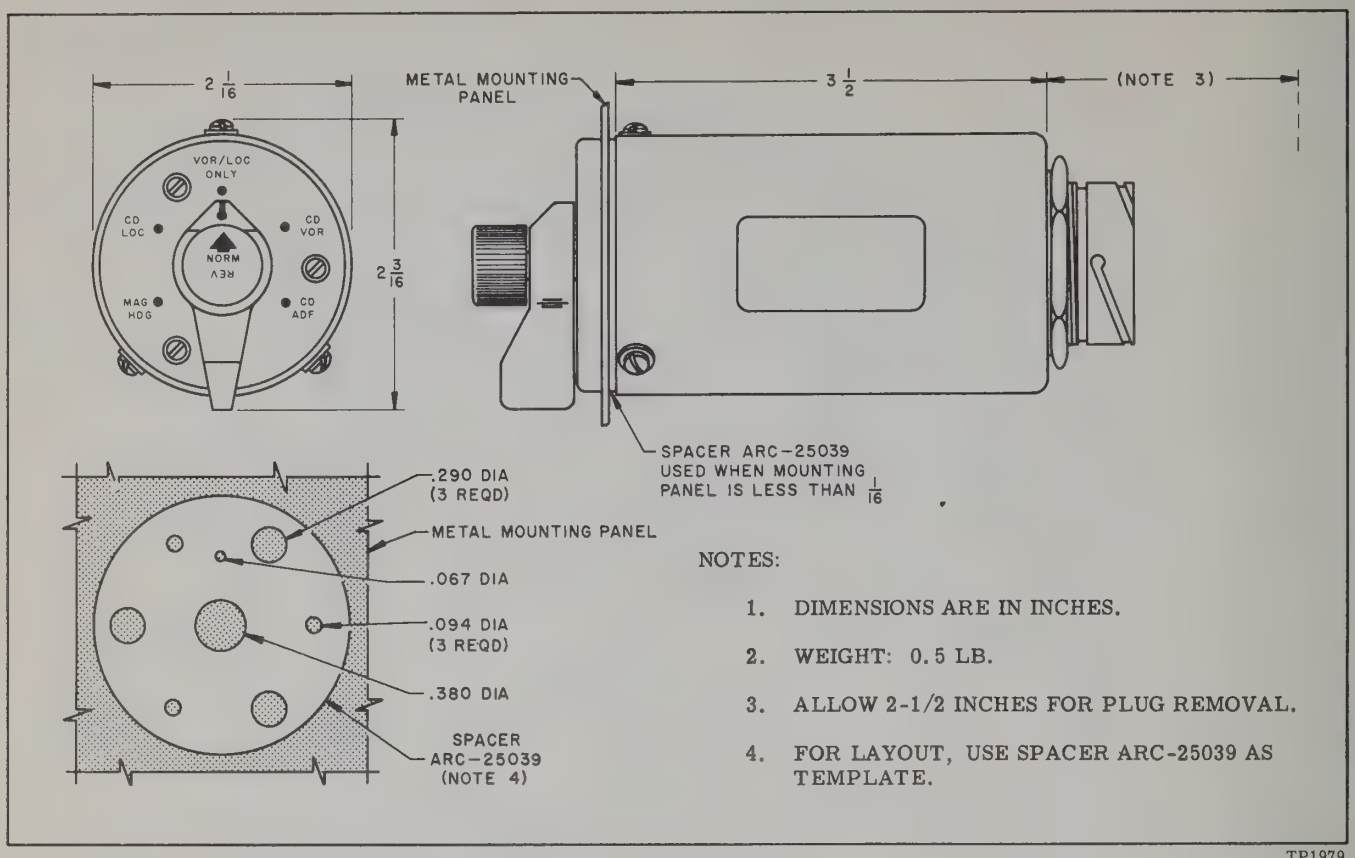




NOTE: DIMENSIONS ARE IN INCHES.

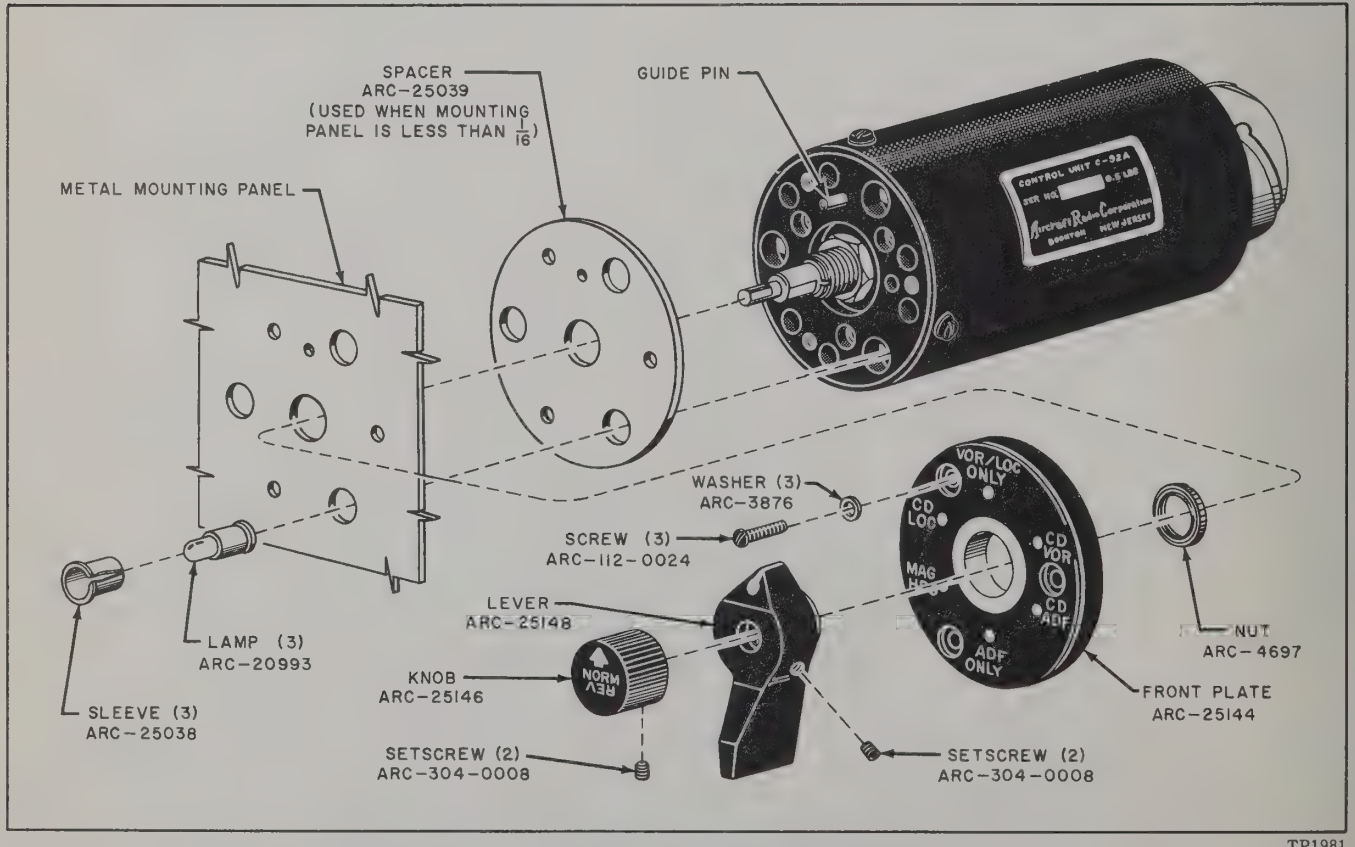
TP3011

Figure 2-8. Wing Installation of CT-11A Compass Transmitter



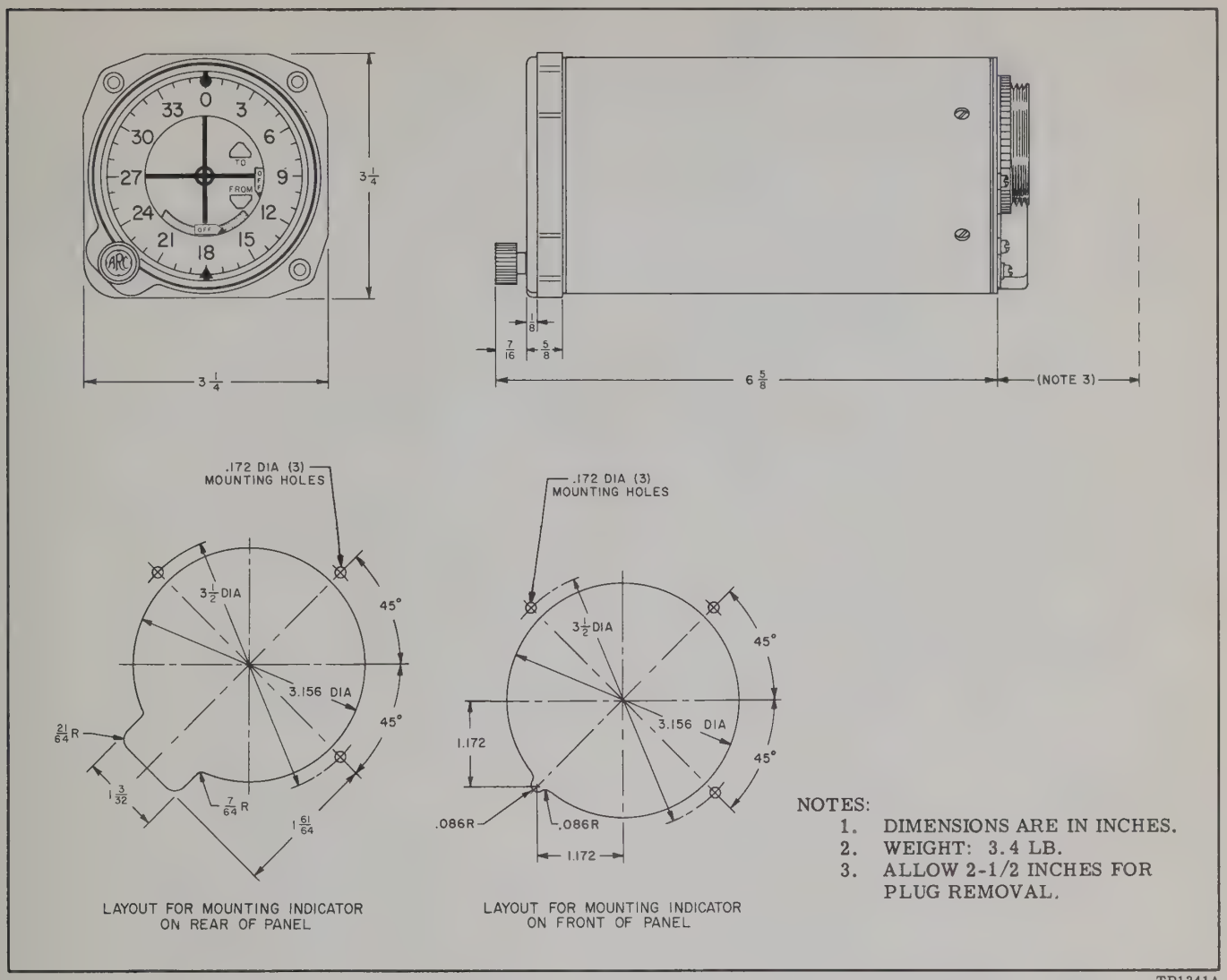
TP1979

Figure 2-9. C-92A Control Unit, Installation Dimensions



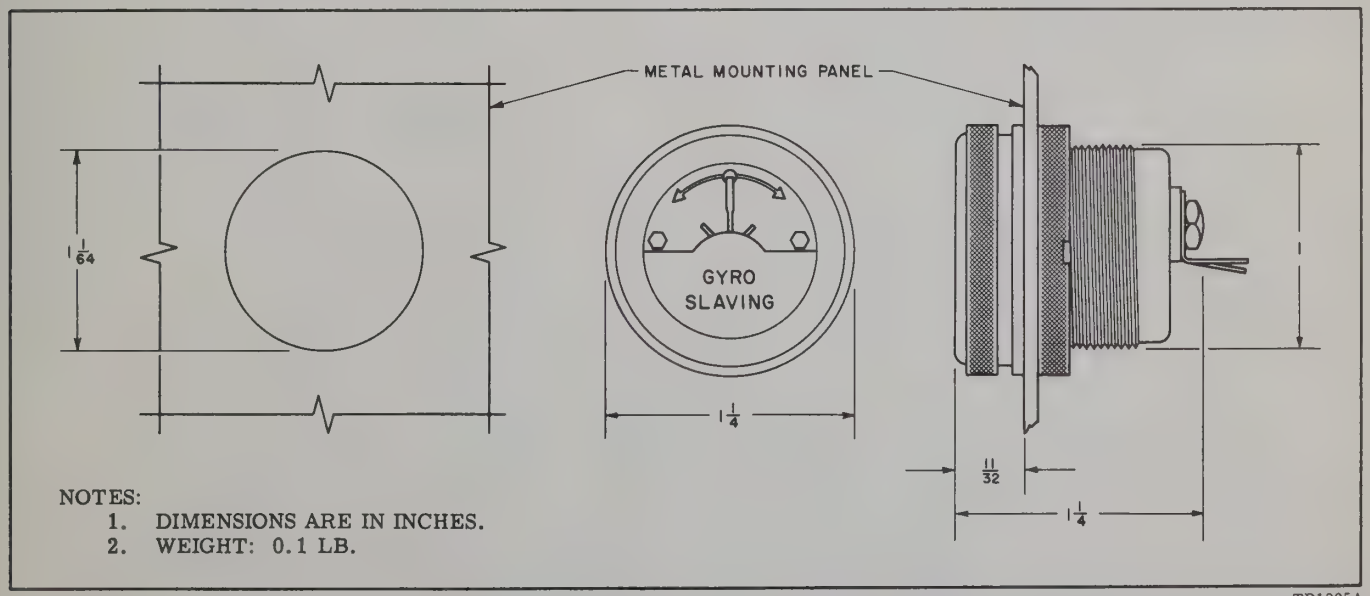
TP1981

Figure 2-10. C-92A Control Unit, Assembly Details



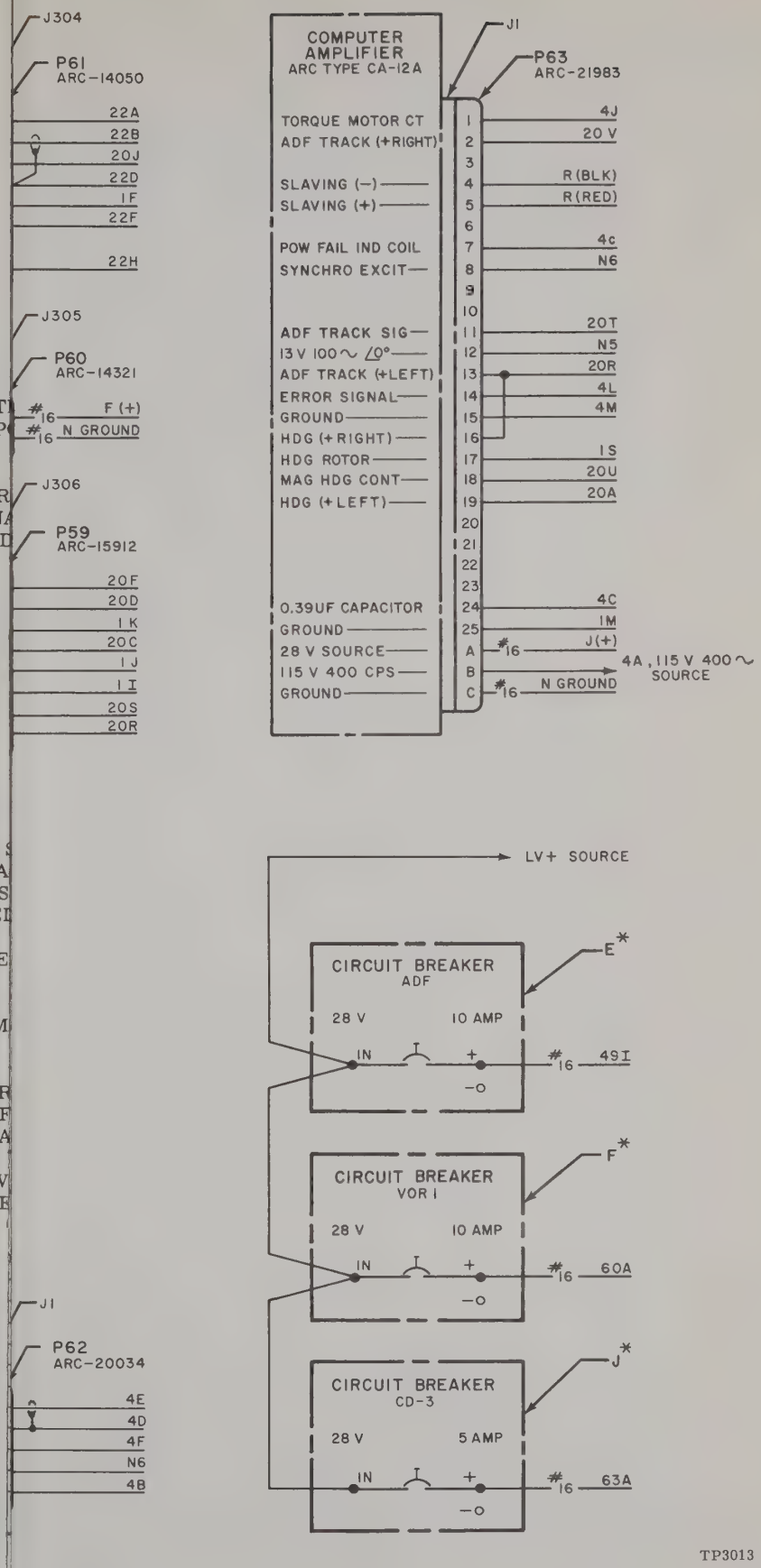
TP1341A

Figure 2-11. IN-14 Course Indicator, Installation Dimensions



TP1005A

Figure 2-12. IN-11 Slaving Meter, Installation Dimensions



NOTES:

1. FOR PROPER GROUNDING OF TI BE CLEAN, BARE METAL AT P ARE FASTENED.

2. CONNECTIONS ARE SHOWN FOR ANTENNA. IF OTHER ANTENNA CONNECTIONS AT UNITS NOTED

   (A) TOP LOOP, BELLY ANTENNA

   (B) BELLY LOOP, TOP ANTENNA

   (C) TOP LOOP, TOP ANTENNA

3. UNMARKED WIRES ARE NO. 20 S INSULATED. MARKED WIRES A FIBROUS-GLASS INSULATED. S TINNED COPPER WITH BRAIDE

4. ITEMS MARKED WITH A SINGLE THE TYPE CD-3 SYSTEM.

5. CONNECTIONS TO TERMINAL M ARE AS FOLLOWS:

   VOR
   ADF
   HEA

6. GYRO CONNECTIONS ARE SHOW MODULE OR EXTERNAL SINGLE SUPPLY.

TP3013

Type CD-3 with ARC Type 15F VHF Navigation Equipment
ARC Type 21A ADF, Interconnection Diagram

NOTES:

1. FOR PROPER GROUNDING OF THE SYSTEM, AIRCRAFT SURFACE MUST BE CLEAN, BARE METAL AT POINTS WHERE UNITS OR UNIT MOUNTINGS ARE FASTENED.

2. CONNECTIONS ARE SHOWN FOR BELLY-MOUNTED LOOP AND SENSE ANTENNA. IF OTHER ANTENNA LOCATIONS ARE USED, INTERCHANGE CONNECTIONS AT UNITS NOTED AS FOLLOWS:

	POWER UNIT	CONTROL UNIT	INDICATOR
(A) TOP LOOP, BELLY ANTENNA	49F & 49G	—	41A & 41B
(B) BELLY LOOP, TOP ANTENNA	49F & 49G	26M & 26L	—
(C) TOP LOOP, TOP ANTENNA	—	26M & 26L	41A & 41B

3. UNMARKED WIRES ARE NO. 20 STRANDED COPPER, FIBROUS-GLASS INSULATED. MARKED WIRES ARE NO. 14 OR NO. 16 STRANDED COPPER, FIBROUS-GLASS INSULATED. SHIELDED WIRES ARE NO. 20 SOLID, TINNED COPPER WITH BRAIDED SHIELD.

4. ITEMS MARKED WITH A SINGLE ASTERISK (*) ARE NOT FURNISHED WITH THE TYPE CD-3 SYSTEM.

5. CONNECTIONS TO TERMINAL MARKED WITH A DOUBLE ASTERISK (**) ARE AS FOLLOWS:

VOR/LOC (+ LEFT)
ADF TRACK (+ LEFT)
HEADING (+ RIGHT)

6. GYRO CONNECTIONS ARE SHOWN FOR USE WITH CA-12A INVERTER MODULE OR EXTERNAL SINGLE PHASE 115 V 400-CPS POWER SUPPLY.

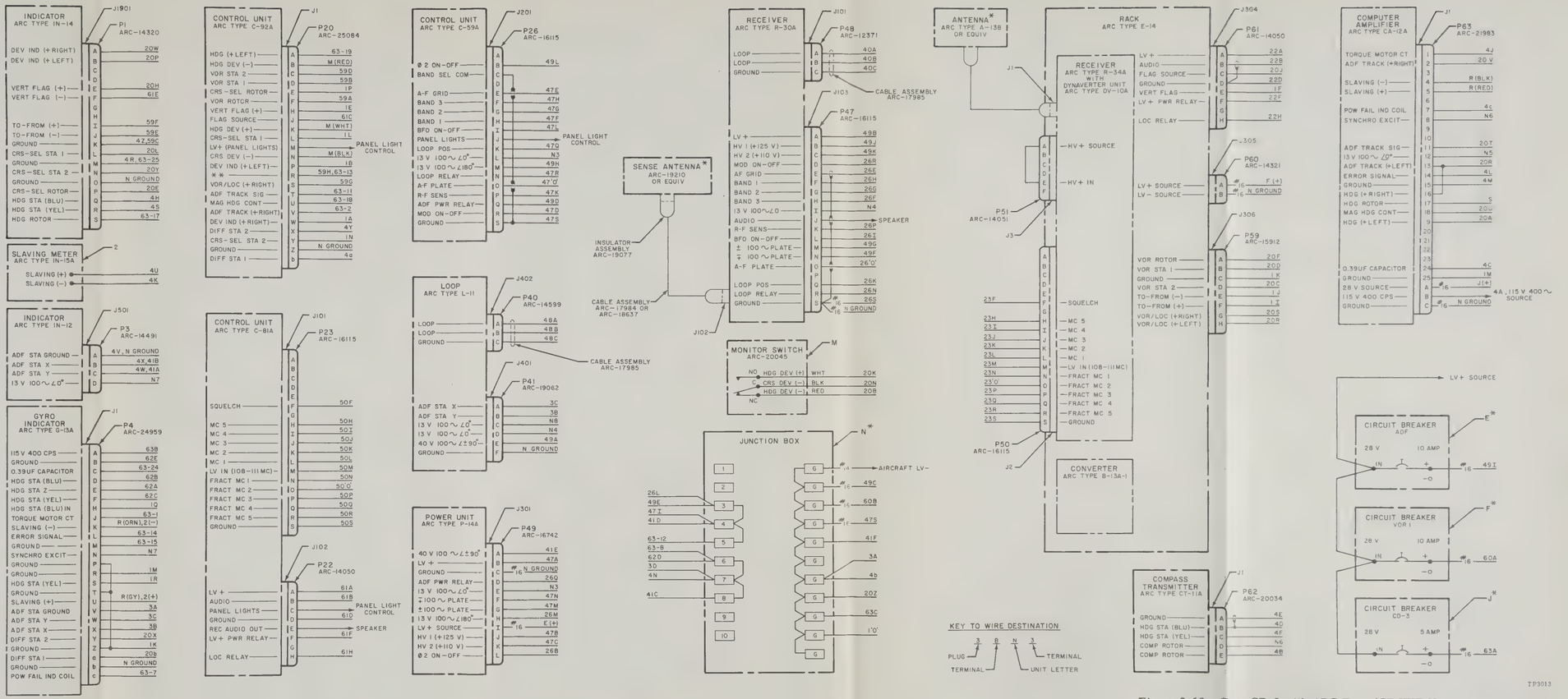


Figure 2-13. Type CD-3 with ARC Type 15F VHF Navigation Equipment and ARC Type 21A ADF, Interconnection Diagram

SECTION III

OPERATION

3-1. INTRODUCTION.

This section contains instructions for using the Type CD-3 for en route tracking using VOR or LF transmitting facilities and for performing precise instrument approaches using localizer, VOR, or ADF receiving equipment.

3-2. OPERATING LIMITATIONS AND PRECAUTIONS.

Operating limitations and precautions affecting the Type 15( ) or the Type 21A are applicable when these equipments are used with the Type CD-3.

> Note
> Compensation of the L-11 Loop is necessary before using the Type CD-3 with the Type 21A ADF. For compensation procedures, refer to the instruction book for the ARC Type 21A Automatic Direction Finder.

3-3. OPERATING CONTROLS.

Operating controls for the Type CD-3 are located on the C-92A Control Unit, IN-14 Course Indicator, and G-13A Gyro Indicator (see Figures 3-1, 3-2, and 3-3). Table 3-1 describes the function of the C-92A controls. The knob on the IN-14 permits selection of a course to or from a VOR or LF station or heading information for the Type CD-3, or both. The knob on the G-13A is used to cage the gyro when necessary.

The monitor switch is used to momentarily remove heading information from the IN-14. This feature is used to determine if the aircraft is on the selected course or on a course to accomplish an intercept. Since both conditions are evidenced by a centered IN-14 vertical pointer, the pilot may determine which condition exists by depressing the monitor switch. If the IN-14 vertical pointer is centered before and while the monitor switch is depressed, the aircraft is on the selected course. If the IN-14 vertical pointer is centered only while the monitor switch is not depressed, the aircraft is on an intercept course. The monitor switch may also be used to determine if the automatic crosswind compensation is being exceeded. After sufficient time for a normal intercept has elapsed, the IN-14 vertical pointer should remain centered when the monitor switch is depressed. After several trials, if the IN-14 vertical pointer continuously deflects off center when the monitor switch is depressed, the automatic crosswind compensation is being exceeded.

TABLE 3-1. C-92A OPERATING CONTROL FUNCTIONS

Switch Position	Function
VOR/LOC ONLY	VOR or localizer track only is presented on IN-14 Course Indicator. Course Director computed steering data omitted.
CD VOR	Computed steering data presented on IN-14. For all en route or approach navigation operations using VOR.
CD ADF	Computed steering data presented on IN-14. For all en route navigation and for performing precise approaches using ADF.
ADF ONLY	Displacement from selected ADF course shown by position of IN-14 vertical pointer. Course director computed steering data omitted.
MAG HDG	Heading indication only is presented on IN-14. Radio navigation signal omitted.
CD LOC	Computed steering data presented on IN-14. For performing precise localizer approaches.
NORM-REV	When in the REV position, connections to the IN-14 are reversed as required to permit flying toward the pointer at all times.

3-4. PREFLIGHT CHECK AND TURN-ON PROCEDURE.

Step 1. With the engine running, apply primary power to the equipment. Allow 3 minutes for warmup.

Step 2. Note the direction of IN-15A Slaving Meter needle deflection. Cage the G-13A Gyro Indicator and turn the caging knob in the direction indicated by the needle until the needle centers.[1] (Full-scale slaving current is produced by ±1° deviation.)

Step 3. Uncage the gyro. Set the C-92A Control Unit function switch at MAG HDG and the C-92A NORM-REV switch to NORM. Rotate the course selector knob of the IN-14 Course Indicator until the IN-14 course selector pointer agrees with the gyro card. The vertical pointer of the IN-14 should center.

Step 4. If a VOT test signal is available, such as from an ARC Type H-14 or H-14A Signal Generator, turn on the VOR equipment and tune in the signal. Set the C-92A function switch to VOR/LOC ONLY and rotate the IN-14 course selector knob until the IN-14 vertical pointer centers.

Step 5. Set the C-92A function switch to CD VOR. Cage the gyro. Turn the gyro card toward deflection-direction of the IN-14 vertical pointer until the vertical pointer centers. The gyro setting should agree, in general, with the setting of the IN-14 course selector pointer.[2]

Step 6. Set the ADF control unit function switch to LOOP. Set the C-92A to ADF ONLY. Slew the loop until the ADF indicator pointer points toward the nose of the aircraft. Cage the gyro and set the gyro card to 0°. Position the IN-14 course selector pointer to 0°. The IN-14 vertical pointer should center.

Step 7. Set the IN-14 course selector pointer to 14°; the IN-14 should deflect full-scale to the left. Slew the ADF indicator pointer 14° to the right of the aircraft nose; the IN-14 vertical pointer should center.

Step 8. Set the IN-14 course selector pointer to 0°; the IN-14 vertical pointer should deflect full-scale to the right. Set the C-92A NORM-REV switch to REV; the IN-14 vertical pointer should deflect full-scale to the left. Set the IN-14 course selector pointer to 180°; the IN-14 vertical pointer should deflect full-scale to the right.

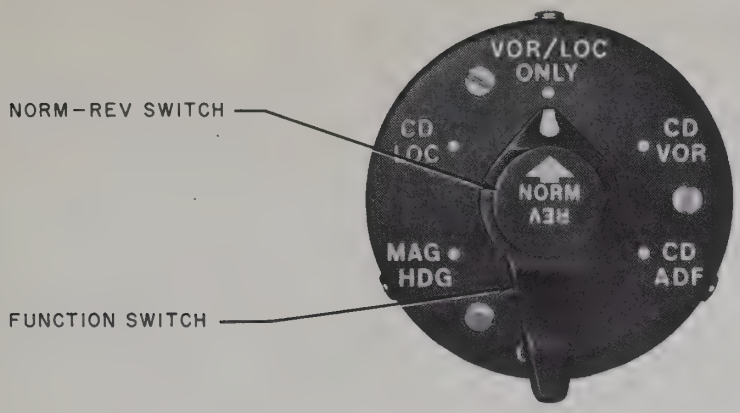
3-5. MAGNETIC HEADING (MAG HDG) OPERATION.

General. The MAG HDG mode of operation provides the pilot with a means for maintaining a desired magnetic heading during take-off or cross-country flying. The desired magnetic heading information is introduced into the CD-3 system by the IN-14 Course Indicator. When the pilot sets the course selector pointer of the IN-14, a signal voltage representing the desired magnetic heading is coupled to the CA-12A Computer Amplifier. The difference between this signal and the actual magnetic heading signal is continuously coupled to the CA-12A from the G-13A Gyro Indicator, thus providing a heading deviation voltage. The heading deviation voltage deflects the IN-14 vertical pointer in the direction the aircraft must turn to attain the desired magnetic heading.

With the function switch of the C-92A Control Unit at MAG HDG, all radio information is removed from the IN-14. With all radio information removed and the IN-14 course selector pointer set to the desired heading, the vertical pointer of the IN-14 shows the direction toward which the aircraft must be flown to attain the desired heading. By turning the aircraft "into the pointer" until the pointer is centered, the correct heading may be attained. If the aircraft heading deviates from the manually set course approximately ±15° or more, right or left full-scale deflection will result. To maintain the desired heading it is necessary to always "fly toward the pointer" and to keep the pointer centered. For example, by setting-in the runway heading on the IN-14 and centering the vertical pointer, directional steering information for take-off is provided on the IN-14. For cross-country flight, after the desired course is set-in, it may be held by keeping the vertical pointer centered.

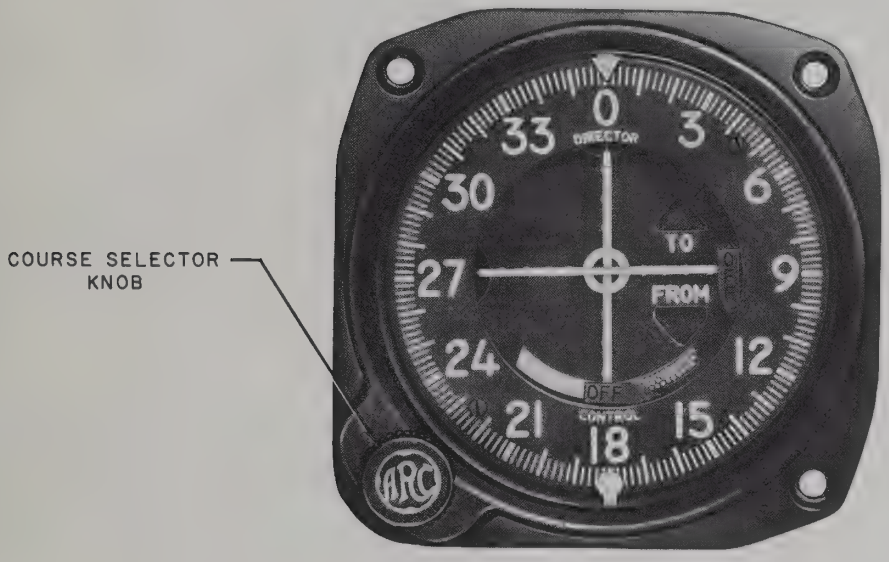
[1] Normal in-flight motion of the IN-15A Slaving Meter needle is back and forth about the zero center, which indicates that the gyro is being slaved continuously.

[2] It is not necessary to reset the gyro during flight unless the gyro tumbles due to violent flight maneuvers or unless the slaving system fails. The gyro will sustain 30° to 35° of climb or dive and up to 60° of bank at 2 G's, or less, without tumbling. If the gyro tumbles, it must be recaged and reset. An inoperative slaving system is indicated when the IN-15A needle remains centered or continuously deflects to one side. In case of slaving system failure, flight may be continued by using the G-13A as a free directional gyro after the slaving disable switch has been turned off (see Figure 2-13). It will then be necessary to reset the gyro from time to time.



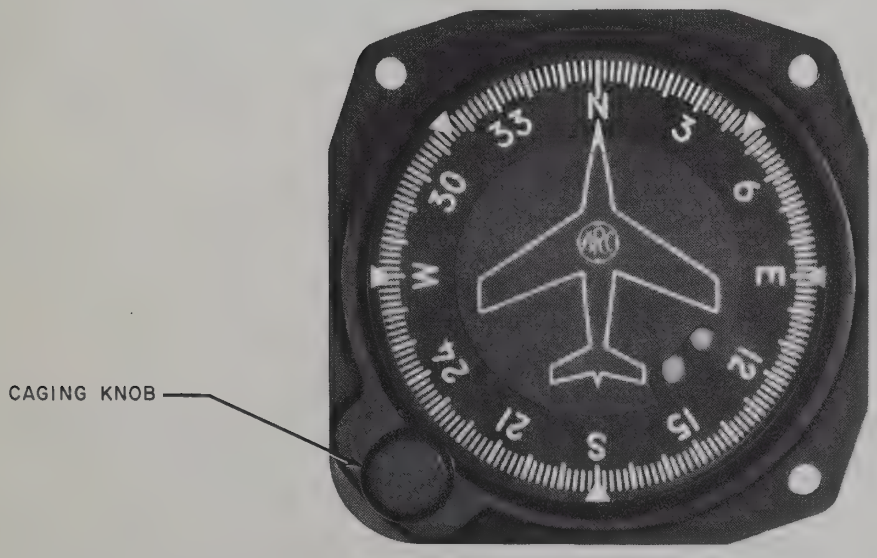
TP1440

Figure 3-1. C-92A Control Unit, Operating Controls



TP1442

Figure 3-2. IN-14 Course Indicator, Operating Control



TP1494

Figure 3-3. G-13A Gyro Indicator, Operating Control

Procedure. To use the MAG HDG mode of operation, proceed as follows:

Step 1. Prepare the Type CD-3 for operation (refer to paragraph 3-4). Set the IN-14 course selector pointer to the desired magnetic heading.

Step 2. Set the C-92A function switch to MAG HDG and the NORM-REV switch to NORM.

Note

Placing the NORM-REV switch at REV has the same effect as rotating the IN-14 course selector pointer 180°.

Step 3. Fly the aircraft "toward the pointer" until the vertical pointer centers. If the vertical pointer is to the right of center, fly to the right; if to the left, fly to the left. With the vertical pointer centered, the aircraft is on the magnetic heading indicated on the IN-14.

Note

If the aircraft is flown away from the vertical pointer, the pointer will center on the reciprocal heading. However, a deviation of 0.5° or more from this heading will require a full 180° turn before the pointer centers again. Thus the ambiguity is resolved almost automatically.

3-6. EN ROUTE VOR OR ADF NAVIGATION.

The Type CD 3 may be used to intercept and maintain a VOR or ADF course. The Type CD-3 will resolve any intercept problem provided the aircraft is in an area approximately ±45° to the desired course. In areas outside this limit it may not be possible to center the pointer. It is then necessary to fly toward the 45° segment on either side of the desired course to effect interception. If it is desired to intercept a course before getting to the station, the procedure should be started at a sufficient distance from the station. For medium-size aircraft, interception is possible if begun 2 to 3 miles from the station.

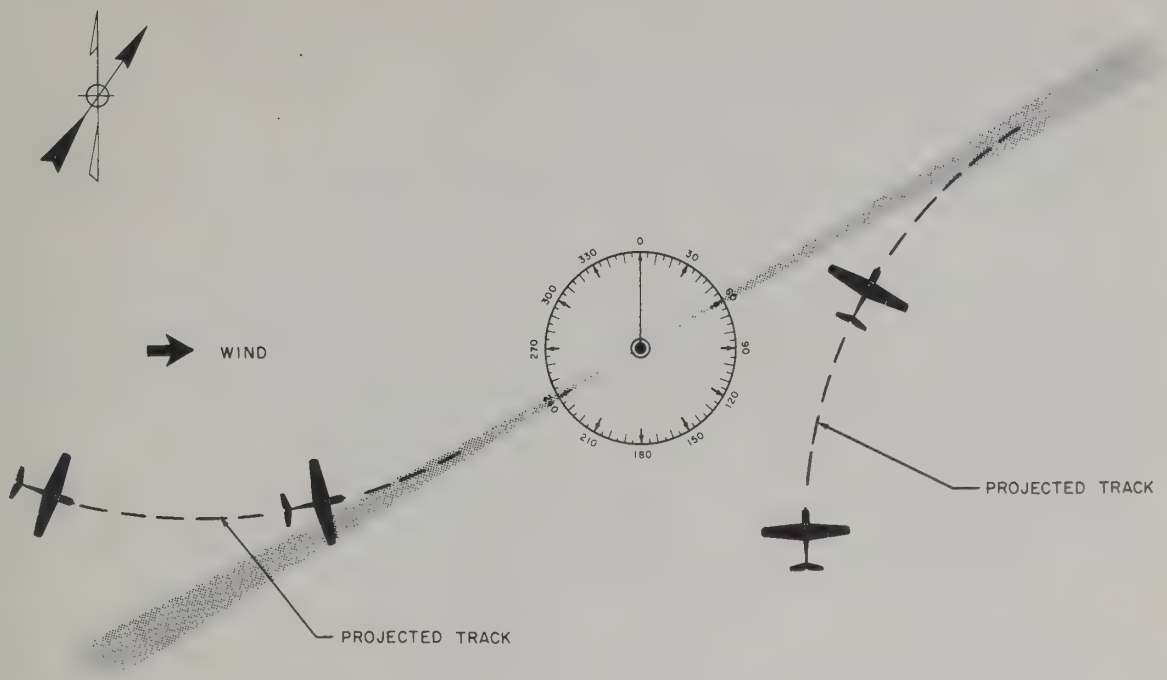
If the aircraft is off the course selected by the IN-14 Course Indicator but within the ±45° interception area, the Type CD-3 establishes an initial heading to intercept the course. The proposed angle of interception (cut) is determined by the angle between the desired course and the aircraft track. The larger the angle, the larger the initial cut. When the aircraft is flown to keep the vertical pointer centered, the Type CD-3 automatically calls for heading changes to reduce the cut as the aircraft approaches the selected course. The cut diminishes until the aircraft is on course and on the proper heading. The Type CD-3 is designed to get the aircraft on course and then maintain the course.

When the desired course is intercepted, the Type CD-3 will provide the correct heading to make the course good. Compensation for crosswinds causing crab angles up to 20° on either side is automatic. Since the Type CD-3 first intercepts and then makes the course good, the course is crossed slightly to the downwind side before full correction is applied. This overshoot is minor because the CA-12A Computer Amplifier solves the crosswind difference rapidly. If the automatic crosswind compensation limit is exceeded (refer to paragraph 3-3), fly with the IN-14 vertical pointer indicating one or two "dots" into the wind to make the VOR or ADF course good. For example, if the wind is from the left, fly with the vertical pointer indicating one or two "dots" to the right of center. If the wind is from the right, fly with the vertical pointer indicating one or two "dots" to the left of center.

The procedure for performing en route VOR navigation using the Type CD-3 is outlined and illustrated in Figure 3-4. The procedure for performing en route ADF navigation using the Type CD-3 is outlined and illustrated in Figure 3-5.

3-7. LOCALIZER OPERATION.

The characteristics of a runway localizer signal differ from a VOR signal; the Type CD-3 responds accordingly. Solution of a localizer problem by the Type CD-3 is not limited as it is for VOR operation (refer to paragraph 3-6). An initial intercept angle of 40° or more is established provided the aircraft is far enough from the desired course. It is not necessary to consider the aircraft position with respect to the ground station to achieve an intercept solution. If the aircraft is to intercept the localizer before arriving at a specific point (e.g., outer marker) the pilot must know his approximate position with respect to the ground station. The approximate position may be determined by checking the ADF indicator. The same rule applies to a runway localizer whether the front course or the back course is to be intercepted.



INBOUND PROCEDURE:

1. Set C-92A function switch to CD VOR and the NORM-REV switch to NORM.
2. Tune ARC Type 15( ) to VOR frequency. Identify.
3. Set IN-14 Course Selector pointer to 60°.
4. TO-FROM meter reads TO.
5. Turn toward IN-14 vertical pointer and keep centered to intercept and maintain selected course.

OUTBOUND PROCEDURE:

1. Set C-92A function switch to CD VOR and the NORM-REV switch to NORM.
2. Tune ARC Type 15( ) to VOR frequency. Identify.
3. Set IN-14 Course Selector pointer to 60°.
4. TO-FROM meter reads FROM.
5. Turn toward IN-14 vertical pointer and keep centered to intercept and maintain selected course.

NOTES:

1. CROSSWIND IS AUTOMATICALLY COMPENSATED WHEN DRIFT ANGLE IS LESS THAN 20°. IF CROSSWIND EXCEEDS AUTOMATIC COMPENSATION, FLY THE VERTICAL POINTER ONE OR TWO DOTS INTO THE WIND FOR ADDITIONAL COMPENSATION.

2. WHEN PASSING OVER VOR STATION, THE VERTICAL POINTER WILL MOVE ERRATICALLY. DO NOT ATTEMPT TO FLY THE POINTER UNTIL OUT OF THIS ZONE OF CONFUSION.

Figure 3-4. Typical En Route VOR Navigation Using Type CD-3 TP1983

As in VOR operation, the Type CD-3 intercepts and then maintains the course. With the IN-14 course selector pointer set to the inbound heading of the localizer (front course), the direction of flight is determined by the function switch of the C-92A Control Unit. By setting the C-92A function switch to CD LOC, an inbound heading on the front course may be established. By setting the NORM-REV switch to REV and the C-92A function switch to CD LOC, an inbound heading on the back course may be established, or an outbound heading on the front course in preparation for a procedure turn. A typical front course ILS approach is illustrated in Figure 3-6.

The Type CD-3 will compensate for 20° of crab due to crosswind for localizer operation. Additional crosswind compensation may be obtained by flying with the IN-14 vertical pointer indicating one or two "dots" into the wind as necessary.

During an ILS approach, changes in wind velocity and direction are compensated automatically so that the aircraft is never permitted to maintain a heading that will result in getting off the course. Because of this feature, missed approaches caused by aircraft heading errors are eliminated. Since the Type CD-3 supplies steering information to aid interception of a desired course, it is possible to use the standard 80° turn immediately after passing the outer marker outbound on an ILS approach. Medium-size aircraft may dispense with any procedure turn at approach speeds. Typical ILS approaches with 45° and 80° procedure turns using the Type CD-3 are outlined and illustrated in Figures 3-7 and 3-8, respectively.

When the monitor switch (part of ARC-20045 Monitor Switch and Cable Assembly) is depressed, all heading information is removed from the IN-14. Under this condition, the approximate displacement of the aircraft from the desired course is indicated by the position of the IN-14 vertical pointer.

3-8. ADF OR VOR APPROACH.

The Type CD-3 may be used to perform a precise instrument approach at any airfield within range of a low-frequency or VOR transmitting facility. By using a nondirectional beacon, broadcast transmitter, en route VOR, or terminal VOR as the source of radio bearing information, the pilot may perform precise instrument approaches previously limited to airfields equipped with a runway localizer.

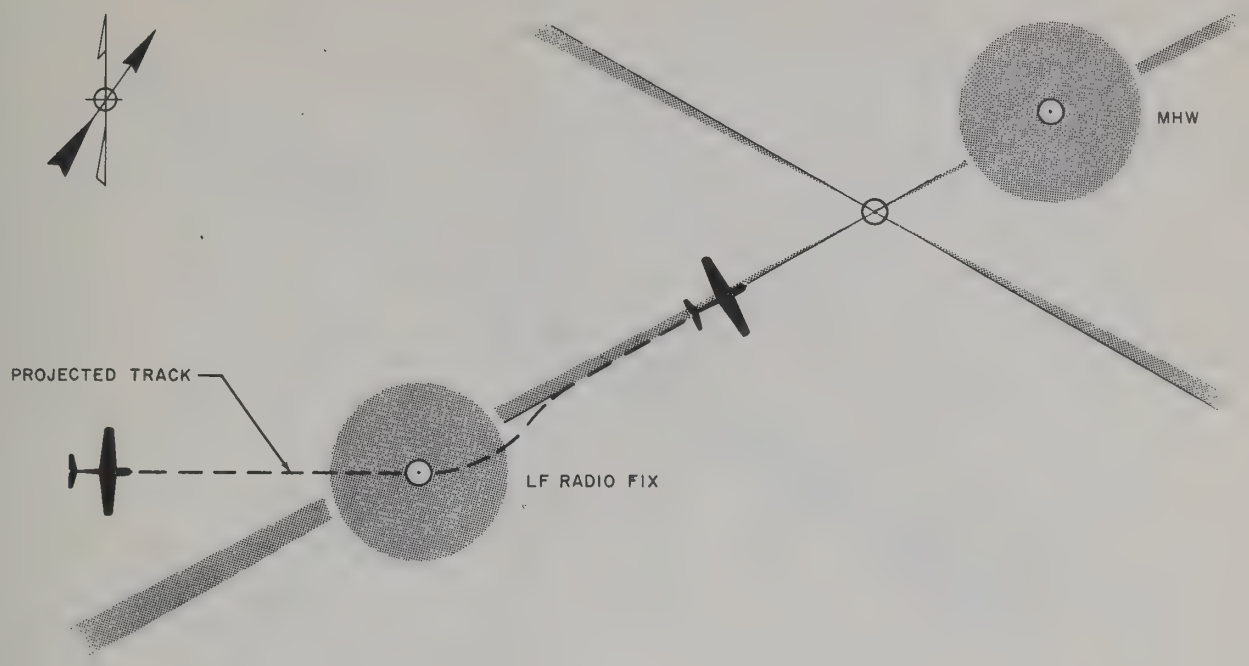
As in localizer operation, the Type CD-3 intercepts and maintains the selected heading. With the IN-14 course selector pointer set at the inbound magnetic heading to the airfield, the direction of flight is determined by the C-92A function switch and the NORM-REV switch. By setting the C-92A function switch to CD ADF and the NORM-REV switch to NORM, an inbound approach at the selected magnetic heading to the airfield may be accomplished. A typical ADF approach is outlined and illustrated in Figure 3-9.

After flying over the low-frequency or VOR transmitting facility it is necessary to fly outbound from the facility for at least one minute before starting the procedure turn.

During final approach, depress the monitor switch as necessary to determine displacement of the aircraft from the selected course. By depressing the monitor switch, computed steering data is removed from the IN-14 vertical pointer circuit and the pointer supplies a visual indication of the lateral position of the aircraft with respect to the selected course. During ADF operation the Type CD-3 will compensate for 20° of crab due to crosswind. Additional crosswind compensation may be obtained by flying with the IN-14 vertical pointer indicating one or two "dots" into the wind as necessary.

3-9. HOLDING PROCEDURES.

Holding procedures at a compass locator on ILS or on a VOR radial are described and illustrated in Figure 3-10. A typical holding procedure at an LF facility is shown in Figure 3-11.

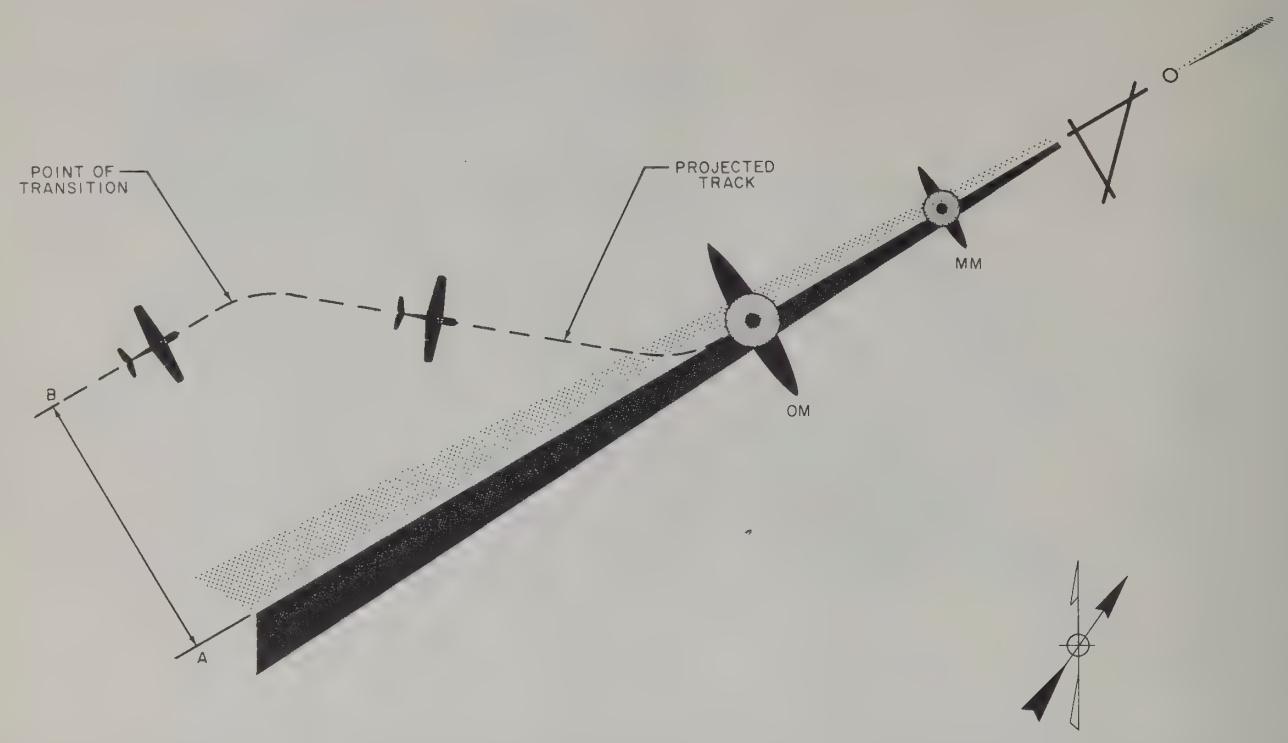


PROCEDURE:

1. Tune ARC Type 21A ADF to frequency of LF radio fix.
2. Set C-92A function switch to ADF ONLY and NORM-REV switch to NORM.
3. Rotate IN-14 course selector knob until vertical pointer centers.
4. Turn function switch to CD ADF and fly to keep vertical pointer centered.
5. After arrival over LF radio fix, set IN-14 course selector pointer to magnetic bearing to MHW from LF radio fix. Continue to fly with vertical pointer centered.
6. After outbound track from LF radio fix is established, tune ARC Type 21A ADF to MHW. Identify. Fly to keep IN-14 vertical pointer centered.

NOTE: THE IN-14 VERTICAL POINTER WILL MOVE ERRATICALLY WHEN PASSING OVER AN LF RADIO FACILITY. DO NOT ATTEMPT TO FLY THE POINTER UNTIL OUT OF THIS ZONE OF CONFUSION.

Figure 3-5. Typical En Route ADF Navigation Using Type CD-3 TP1985



PROCEDURE:

If aircraft position is such that interception of localizer can be made prior to arrival at outer marker (see Note 4), proceed as follows:

1. Tune ARC Type 15( ) to localizer frequency. Identify.
2. Set IN-14 course selector pointer to inbound runway heading.
3. Set C-92A function switch to CD LOC and NORM-REV switch to NORM.
4. Steer to keep IN-14 vertical pointer centered; intercept and follow front-course approach.

NOTES:

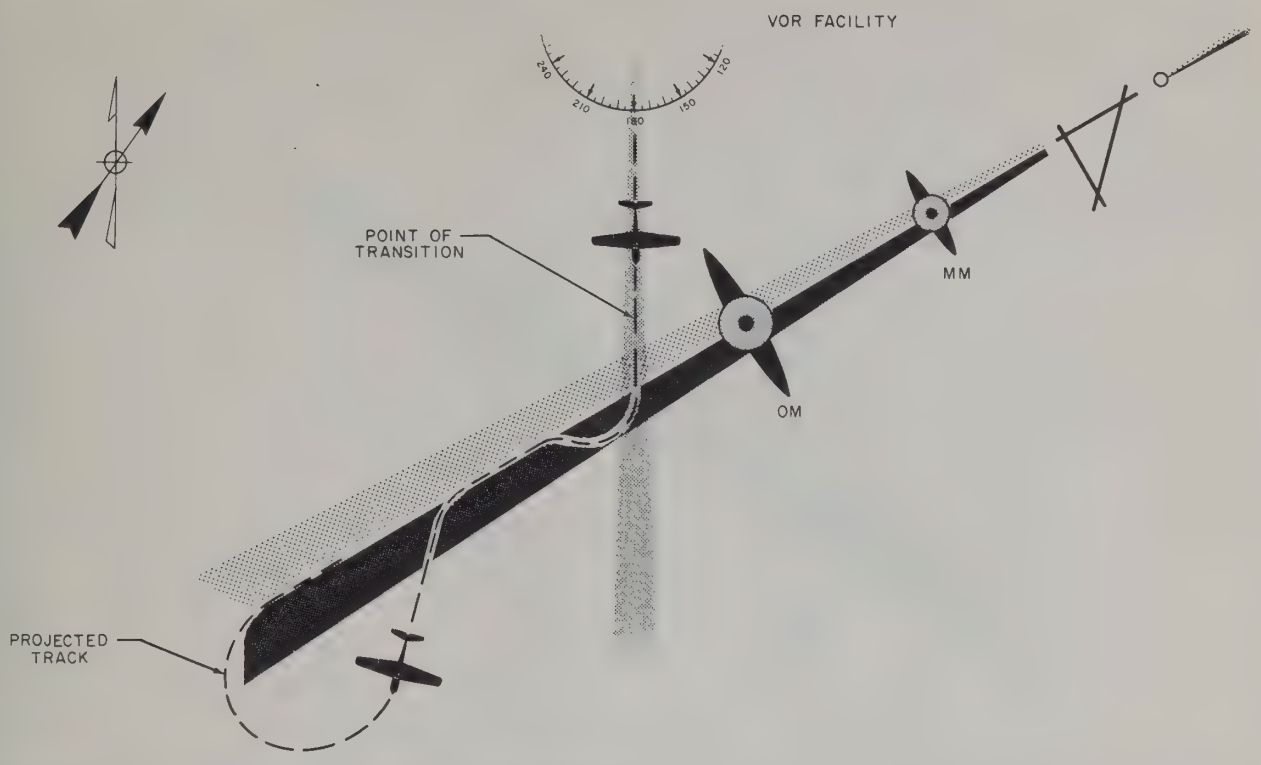
1. ALL LOCALIZER BEAMS HAVE NULLS IN AN AREA EXTENDING APPROXIMATELY 2 MILES FROM THE LOCALIZER SHACK AT ALTITUDES ABOVE NORMAL APPROACH HEIGHT. DO NOT ATTEMPT TO FLY PRECISE TRACKS IN THESE AREAS.

2. THE CD-3 NEEDS ONLY THE INFORMATION PUBLISHED FOR FRONT-COURSE APPROACH TO ACCOMPLISH EITHER FRONT-COURSE OR BACK-COURSE PROCEDURES.

3. BACK-COURSE APPROACHES MAY BE ACCOMPLISHED IN THE SAME MANNER, EXCEPT THAT ON THE FINAL APPROACH, SET THE C-92A NORM-REV SWITCH TO REV.

4. DISTANCE FROM A TO B CAN BE APPROXIMATELY 75 PER CENT OF DISTANCE FROM A TO OUTER MARKER, AT 120 MPH (OR LESS) APPROACH SPEEDS.

Figure 3-6. Typical ILS Approach Using Type CD-3 TP1987



PROCEDURE:

1. Track out from VOR or LF facility to vicinity of outer compass locator.
2. Tune ARC Type 15( ) to localizer and identify as soon as possible after leaving VOR or LF facility.
3. Set C-92A function switch to VOR/LOC ONLY. Set IN-14 course selector pointer to inbound runway heading.
4. Fly by VOR ADF until IN-14 vertical pointer just leaves pin.
5. Set C-92A function switch to CD LOC and NORM-REV switch to REV. Steer to center IN-14 vertical pointer.
6. After front course is intercepted, turn 45° off course (as shown on approach chart) to procedure turn.
7. When halfway through turn, switch C-92A NORM-REV switch to NORM.
8. Steer to center IN-14 vertical pointer; intercept and follow front-course approach.

CAUTION

Set in only the published bearing of the front-course of No. 1 approach on the IN-14.

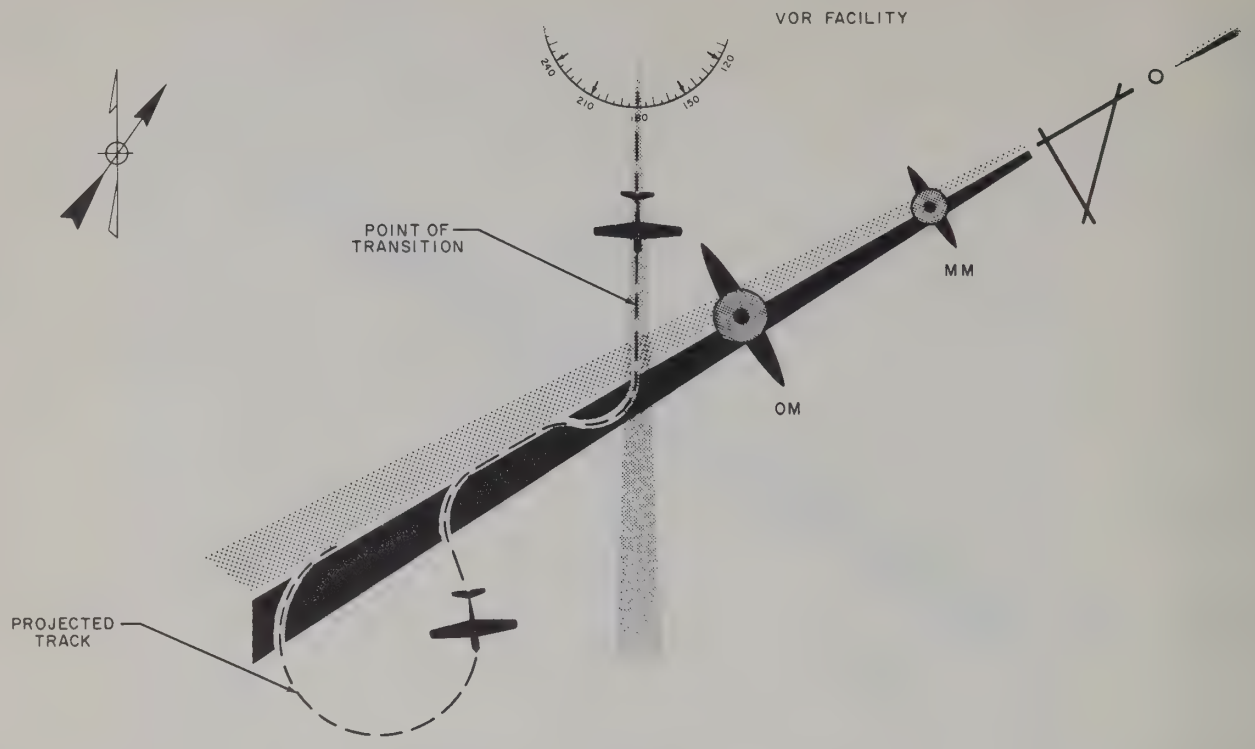
NOTES:

1. ALL LOCALIZER BEAMS HAVE NULLS IN AN AREA EXTENDING APPROXIMATELY 2 MILES FROM THE LOCALIZER SHACK AT ALTITUDES ABOVE NORMAL APPROACH HEIGHT. DO NOT ATTEMPT TO FLY PRECISE TRACKS IN THESE AREAS.

2. THE CD-3 NEEDS ONLY THE INFORMATION PUBLISHED FOR FRONT-COURSE APPROACH TO ACCOMPLISH EITHER FRONT-COURSE OR BACK-COURSE PROCEDURES.

3. BACK-COURSE APPROACHES MAY BE ACCOMPLISHED IN THE SAME MANNER, EXCEPT THAT ON THE FINAL APPROACH, SET THE C-92A NORM-REV SWITCH TO REV.

Figure 3-7. Typical ILS Approach with 45-Degree Procedure Turn Using Type CD-3 TP1989



PROCEDURE:

1. Track out from VOR or LF facility to vicinity of outer compass locator.
2. Tune ARC Type 15( ) to localizer and identify as soon as possible after leaving VOR or LF facility.
3. Set C-92A function switch to VOR/LOC ONLY. Set IN-14 course selector pointer to inbound runway heading.
4. Fly by VOR ADF until IN-14 vertical pointer just leaves pin.
5. Set C-92A function switch to CD LOC and NORM-REV switch to REV. Steer to center IN-14 vertical pointer.
6. After front course is intercepted, turn 80° off course (as shown on approach chart) to procedure turn.
7. When halfway through turn, switch C-92A NORM-REV switch to NORM.
8. Steer to center IN-14 vertical pointer; intercept and follow front-course approach.

CAUTION

Set in only the published bearing of the front-course of No. 1 approach on the IN-14.

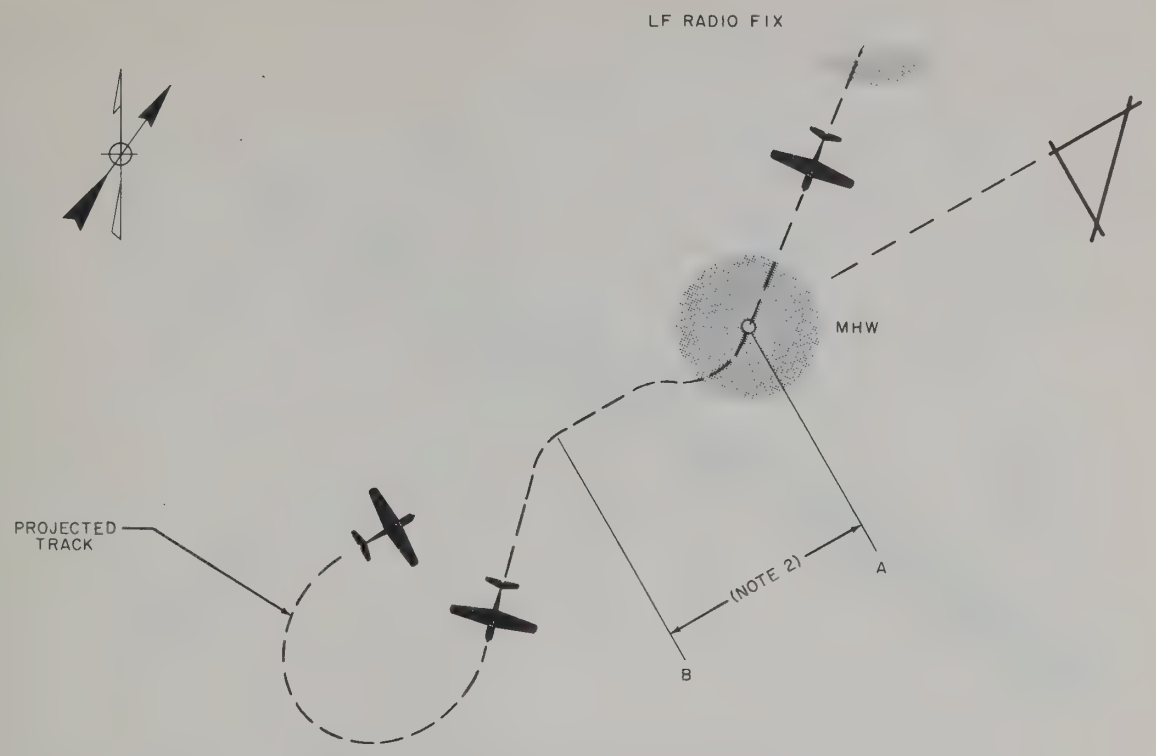
NOTES:

1. ALL LOCALIZER BEAMS HAVE NULLS IN AN AREA EXTENDING APPROXIMATELY 2 MILES FROM THE LOCALIZER SHACK AT ALTITUDES ABOVE NORMAL APPROACH HEIGHT. DO NOT ATTEMPT TO FLY PRECISE TRACKS IN THESE AREAS.

2. THE CD-3 NEEDS ONLY THE INFORMATION PUBLISHED FOR FRONT-COURSE APPROACH TO ACCOMPLISH EITHER FRONT-COURSE OR BACK-COURSE PROCEDURES.

3. BACK-COURSE APPROACHES MAY BE ACCOMPLISHED IN THE SAME MANNER, EXCEPT THAT ON THE FINAL APPROACH, SET THE C-92A NORM-REV SWITCH TO REV.

Figure 3-8. Typical ILS Approach with 80-Degree Procedure Turn Using Type CD-3 TP1991



PROCEDURE:

1. Using en route navigation procedures, fly outbound from LF radio fix toward MHW. After establishing an outbound track from LF radio fix, tune ARC Type 21A ADF to MHW. Identify.
2. After arrival over MHW, set IN-14 course selector pointer at inbound magnetic heading to airfield, C-92A function switch to CD ADF, and NORM-REV switch to REV. Center IN-14 vertical pointer and fly outbound from MHW for a minimum of one minute (depending on wind conditions).
3. Start 45° procedure turn. Hold procedure turn heading for approximately 45 seconds. IN-14 vertical pointer will move toward right.
4. Start 180° turn back toward IN-14 vertical pointer. When vertical pointer centers, set C-92A NORM-REV switch to NORM.
5. Steer toward IN-14 vertical pointer and then keep the pointer centered to accomplish approach.

NOTES:

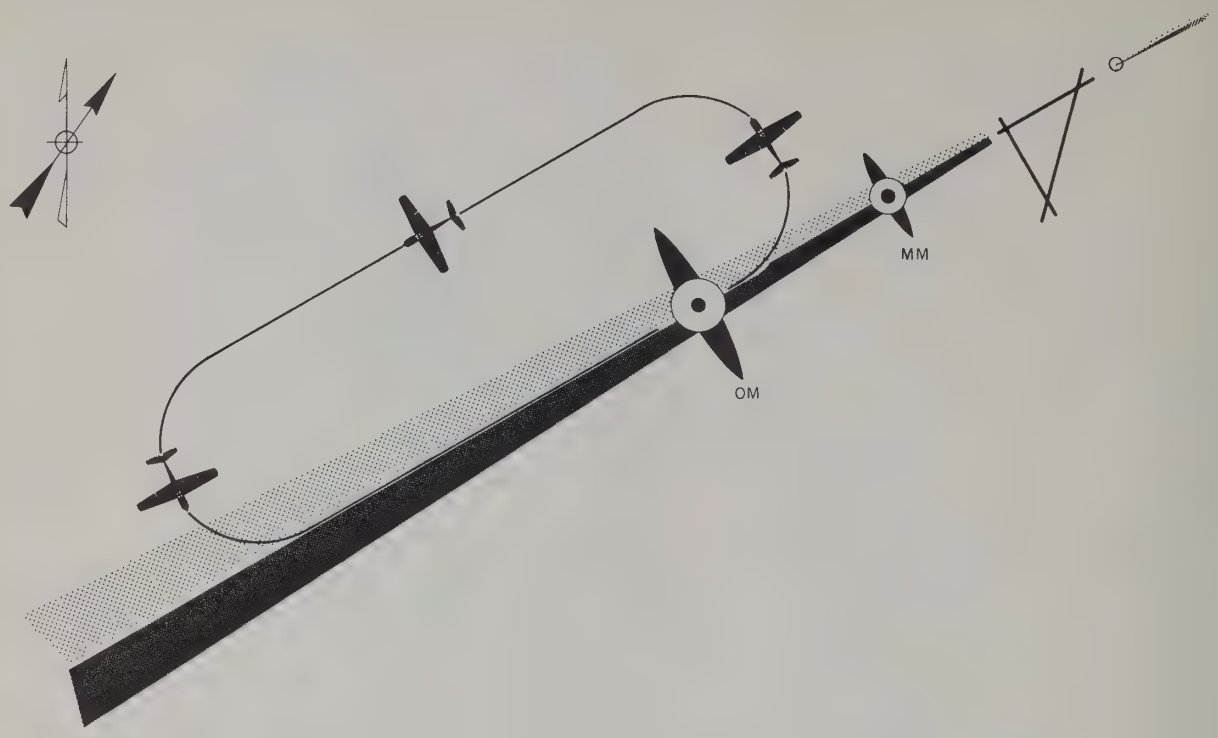
1. DURING FINAL APPROACH, DEPRESS THE MONITOR SWITCH AS NECESSARY TO DETERMINE DISPLACEMENT OF AIRCRAFT FROM THE SELECTED COURSE.

2. TIME BETWEEN POINTS A AND B SHOULD BE APPROXIMATELY 1 MINUTE DEPENDING ON WIND CONDITIONS.

3. THE VERTICAL POINTER WILL MOVE ERRATICALLY WHEN PASSING OVER THE MHW. DO NOT ATTEMPT TO FLY THE POINTER UNTIL OUT OF THIS ZONE OF CONFUSION.

Figure 3-9. Typical ADF Approach Using Type CD-3

TP1993



HOLDING AT COMPASS LOCATOR ON ILS:

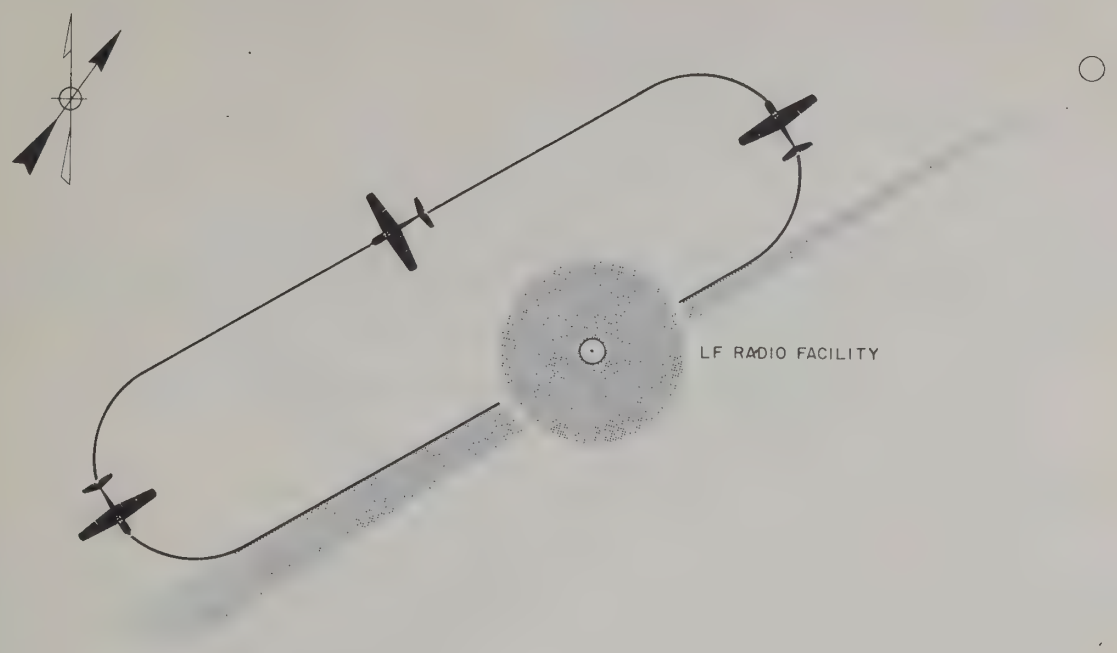
1. Tune ARC Type 15( ) to localizer frequency.
2. Set IN-14 course selector pointer for front-course approach.
3. At LOM start right or left turn as directed.
4. Set C-92A function switch to MAG HDG and NORM-REV switch to REV.
5. Continue turn until IN-14 vertical pointer centers. Keep the pointer centered and fly outbound for the desired time.
6. At expiration of time, start turn back toward localizer.
7. After turn is started, set C-92A function switch to CD LOC and NORM-REV switch to NORM.
8. Continue turning until IN-14 vertical pointer centers. Keep pointer centered to reintercept localizer.

HOLDING ON VOR RADIAL:

Holding procedures using a VOR radial are accomplished in a similar manner as for ILS, except that the C-92A function switch is set to CD VOR.

TP1995

Figure 3-10. Typical Holding Procedure at Compass Locator on ILS or on VOR Radial Using Type CD-3



PROCEDURE:

1. Tune ARC Type 21A ADF to LF facility.
2. Set IN-14 course selector pointer to desired magnetic heading.
3. At LF facility start right or left turn as directed.
4. Set C-92A function switch to MAG HDG and NORM-REV switch to REV.
5. Continue turn until IN-14 vertical pointer centers. Keep the pointer centered and fly outbound for the desired time.
6. At expiration of time start turn back toward LF facility.
7. After turn is started, set C-92A function switch to CD ADF and NORM-REV switch to NORM.
8. Continue turning until IN-14 vertical pointer centers. Keep pointer centered to again fly over LF facility.

Figure 3-11. Typical Holding Procedure at LF Facility Using Type CD-3

TP1997

SECTION IV

MAINTENANCE

4-1. INTRODUCTION.

This section contains maintenance information for the Type CD-3. Included are individual maintenance procedures for each of the major units and voltage and resistance measurements. Schematic and wiring diagrams for the units are contained in Section V.

WARNING
Voltages in this equipment are dangerous and may be fatal if contacted. Observe all safety precautions.

4-2. MAINTENANCE OF CA-12A.

Module Removal and Replacement. To remove any of the five printed-circuit modules, first remove the dust cover, then remove the two flat head screws (one at each end) that secure the module to the chassis. Then, using a screwdriver in each of the two appropriate slots in the chassis, apply force upward until the jacks on the edge of the module printed-circuit board are freed from the mating pins on the chassis printed-circuit board. Remove the screwdrivers and lift the module out. To replace the module, slide it in place until the pins on the printed-circuit board fully engage the jacks on the edge of the module printed-circuit board. Secure the module to the chassis with the two flat head screws previously removed.

Replacement of Semiconductor Devices. Table 4-1 lists the transistors and crystal diodes contained in the CA-12A. The table contains information on the general location of each semiconductor and a reference to the wiring diagram illustrating the part.

Before soldering a semiconductor, disconnect the power source and make sure the soldering iron is grounded. When soldering, hold pliers between the solder joint and the semiconductor. The pliers form a heat sink and prevent excessive heat from damaging the part. Always use a small, hot iron (35 watts or less) when soldering. Always check polarity and route the semiconductor leads as nearly like the original as possible.

TABLE 4-1. LOCATION OF CA-12A SEMICONDUCTOR DEVICES

Part	Type	ARC Part No.	Wiring Diagram Figure No.
A1CR1	1N537	8957-0002	5-3
A1CR2	1N537	8957-0002	5-3
A1CR3	651C5	8874	5-3
A1CR4	651C5	8874	5-3
A2CR1	1N536	8957-0001	5-4
A2CR2	1N536	8957-0001	5-4
A3CR1	1N537	8957-0002	5-5
A3CR2	1N537	8957-0002	5-5
A3Q1	2N586	25584	5-5
A3Q2	2N586	25584	5-5
A3Q3	2N1183A	8984-0002	5-5
A3Q4	2N1183A	8984-0002	5-5
A4Q1	2N270	22635	5-6
A4Q2	2N586	25584	5-6
[1]A5Q1	2N1183B	8984-0003	5-7
[2]1Q1	2N174	26119	5-2
[2]1Q2	2N174	26119	5-2

[1]Contained in A5 inverter module only.
[2]Installed in CA-12A when inverter A5 is used.

Voltage and Resistance Measurements. Typical voltage and resistance measurements for the CA-12A are listed in Tables 4-2 and 4-3. All readings are approximate with a tolerance of ±20%.

TABLE 4-2. VOLTAGE MEASUREMENTS FOR CA-12A COMPUTER AMPLIFIER

Conditions:

1. Type CD-3 interconnected as shown in Figure 2-13. Input power set at 27.5 volts dc and if power transformer A5 is used, 115 volts ac, 400 cps.
2. Measurements made with Hewlett-Packard Model 410B connected between the points indicated.
3. Measurements for A1 made with G-13A at 0°, IN-14 at 040°, and C-92A on VOR/LOC only.
4. Measurements for A2 made with G-13A at 0°, IN-14 at 015°, and C-92A on ADF ONLY.
5. Measurements for A3 and A4 made with G-13A at 45°.

Connect Meter Between		Voltage Reading	
		D-C	A-C
A1E	ground	0	0
A1I	A1P	-	44.0
A1Q*	A1T	0.2	-
A1Q*	A1R	7.0	-
A1S	ground	-	14.0
A1U	A1V*	4.0	-
A1V*	A1W	0.7	-
A2E	ground	0	0
A2F	ground	25.5	-
A2G	A2P*	0.5	-
A2I	ground	-	26.0
A2O	ground	0	0
A2Q	ground	-	2.0
A3E	ground	0	0
A3F	ground	25.5	-
A3G	ground	11.5	-
A3H	ground	14.0	-
A3L	ground	24.0	-
A3M	ground	-	26.0
A3N	ground	-	26.0
A3O	ground	0	0
A3P	ground	14.0	0
A3Q	ground	1.2	9.0
A4E	ground	0	0
A4F	ground	25.5	-
A4G	ground	11.5	0.35
A4O	ground	11.5	3.0
A4P	ground	1.2	9.0
A4Q	ground	11.0	0.2
A5E†	ground	0	0
A5F†	ground	25.5	-
A5G†	ground	24.5	-
A5H†	ground	24.5	-
A5R†	ground	25.5	-
A5S†	ground	25.0	-
A5J	A5Q†	-	44.0
A5M	ground	-	26.0
A5N	ground	-	26.0
A5P	ground	-	115.0

*Connect negative meter probe to this point.
†On Inverter A5 only.

TABLE 4-3. TRANSISTOR PIN VOLTAGE AND RESISTANCE MEASUREMENTS FOR CA-12A COMPUTER AMPLIFIER

Conditions:

1. Input power level for a-c and d-c measurements set at 27.5 volts dc and (for power transformer A5 only) 115 volts ac, 400 cps.
2. D-C measurements.
   a. Type CD-3 interconnected as shown in Figure 2-13.
   b. Hewlett-Packard Model 410B vtvm with negative terminal grounded to chassis used for measurements.
   c. G-13A Gyro Indicator set to 45°.
3. A-C measurements.
   a. Type CD-3 interconnected as shown in Figure 2-13.
   b. Ballantine Model 300 vtvm with appropriate terminal grounded to chassis used for measurements.
   c. G-13A Gyro Indicator set to 45°.
4. Resistance measurements.
   a. Type CD-3 interconnected as shown in Figure 2-13.
   b. Hewlett-Packard Model 410B vtvm with negative terminal grounded to chassis used for measurements.
   c. Measurements are in ohms; multiplier K=1000.
   d. Readings of 1K or over taken on Rx100 scale; all other readings taken on Rx1 scale.

Transistor Pin		DC	AC	Resistance
[1]1Q1	Emitter	24.5	17.0	30
	Base	25.5	18.5	35
	Collector	-	-	-
[1]1Q2	Emitter	24.5	17.0	30
	Base	25.5	18.5	35
	Collector	-	-	-
A3Q1	Emitter	25.2	0.8	12K
	Base	25.5	1.3	18K
	Collector	13.4	13.5	25K
A3Q2	Emitter	25.4	0.8	12K
	Base	25.5	1.3	18K
	Collector	25.9	1.4	25K
A3Q3	Emitter	0	0	1K
	Base	13.4	13.5	25K
	Collector	0	0	0
A3Q4	Emitter	14.0	-	4K
	Base	25.9	1.4	25K
	Collector	0	0	0
A4Q1	Emitter	9.8	0.38	1.3K
	Base	11.5	3.0	3.0K
	Collector	4.0	5.8	1.3K
A4Q2	Emitter	11.5	0.35	700
	Base	12.0	0.8	750
	Collector	1.2	9.0	100

[1]Used only when A5 inverter is installed.

4-3. MAINTENANCE OF G-13A AND CT-11A.

The G-13A Gyro Indicator and the CT-11A Compass Transmitter have been carefully checked at the factory before shipment. Other than routine system checks, the units require no special maintenance or lubrication. Periodically, and when checks indicate unsatisfactory operation, the units should be returned to the factory for inspection and repair. When field test equipment and maintenance data are available, qualified personnel may perform the periodic tests and minor repairs.

Caution

Use extreme care in handling the gyro indicator. Always place it on a cushion or pad while it is out of its carton or off the instrument panel. Never remove the instrument cover.

4-4. MAINTENANCE OF C-92A.

Replacement of Panel Lamps. The C-92A Control Unit uses either three No. 327 (28-volt) or No. 330 (14-volt) midget flange-base panel lamps. To replace a lamp, proceed as follows:

Step 1. Loosen the setscrews and remove the NORM-REV switch knob and the function switch lever from the C-92A shaft.

Step 2. Detach the front plate by removing the three attaching flat head screws.

Step 3. With the thin edge of a knife blade or with the fingernails of the thumb and forefinger, pry the sleeve from the defective lamp, then withdraw the defective lamp.

Step 4. Insert a new lamp, and replace the sleeve.

Step 5. Replace the front plate, function switch lever, and NORM-REV switch lever, using the hardware previously removed.

Disassembly for Internal Maintenance. Detach the plug from the rear of the C-92A. Remove the unit from the instrument panel (see Figure 2-10). Remove the nut holding the receptacle to the unit. Remove the three screws adjacent to the function switch knob and slide off the cover.

Replacement of Crystal Diodes. As shown in Figure 5-11, two crystal diodes are contained in the C-92A. If replacement is necessary, follow the crystal diode replacement procedure outlined in paragraph 4-2.

4-5. MAINTENANCE OF IN-14.

Connections to the IN-14 Course Indicator should be inspected if operation is erratic. If necessary, disconnect the plug from the rear of the unit and remove the three screws that secure the IN-14 to the instrument panel. Lift the instrument from its mounting position. If disassembly or overhaul is required, refer to "Overhaul Instructions and Parts Catalog for ARC Type IN-14 Course Indicator."

SECTION V

DIAGRAMS

Figure 5-1. CA-12A Computer Amplifier, Schematic Diagram

Figure 5-2. CA-12A Computer Amplifier Chassis, Wiring Diagram

Figure 5-3. CA-12A Computer Amplifier, Computer Assembly A1, Wiring Diagram

Figure 5-4. CA-12A Computer Amplifier Track Bridge Assembly A2, Wiring Diagram

Figure 5-5. CA-12A Computer Amplifier Slaving No. 2 Assembly A3, Wiring Diagram

Figure 5-6. CA-12A Computer Amplifier Slaving No. 1 Assembly A4, Wiring Diagram

Figure 5-7. CA-12A Computer Amplifier Inverter Assembly A5, Wiring Diagram

Figure 5-8. CA-12A Computer Amplifier Power Transformer Assembly A5, Wiring Diagram

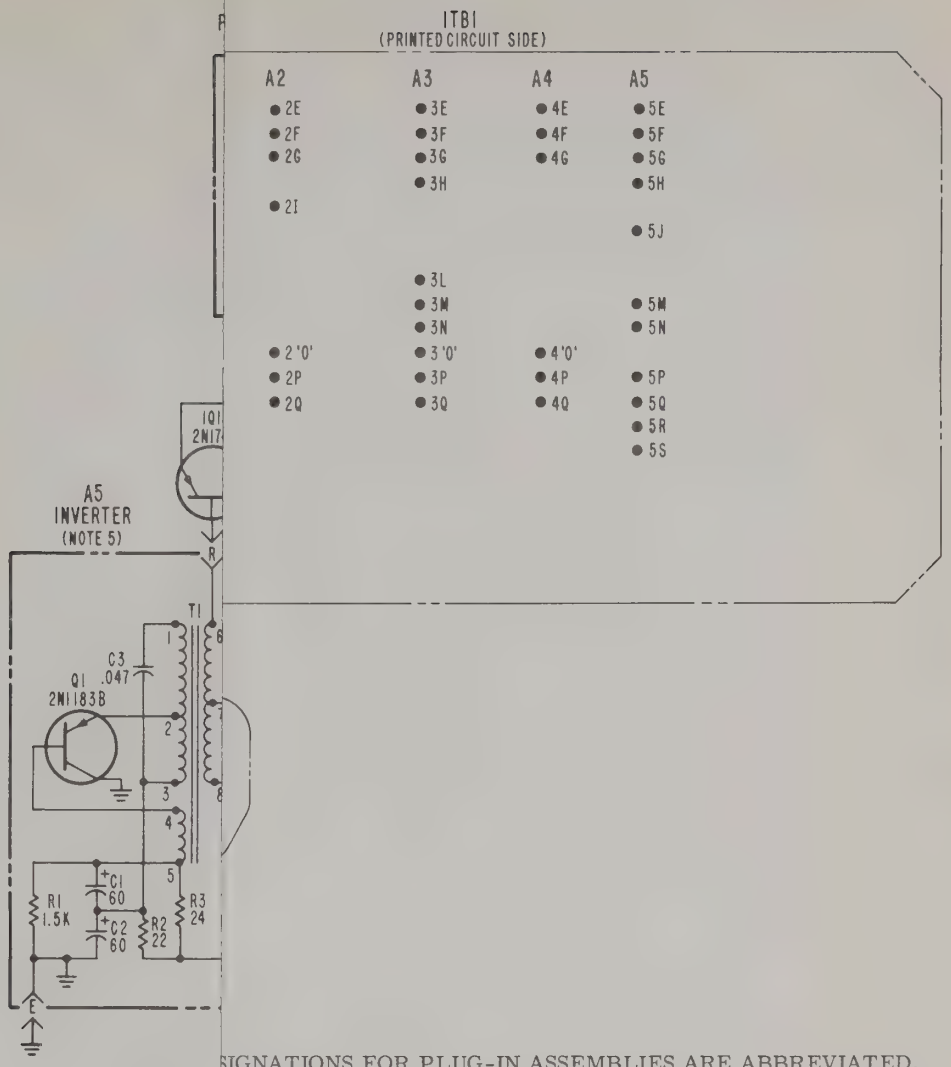
Figure 5-9. G-13A Gyro Indicator, Schematic Diagram

Figure 5-10. C-92A Control Unit, Schematic Diagram

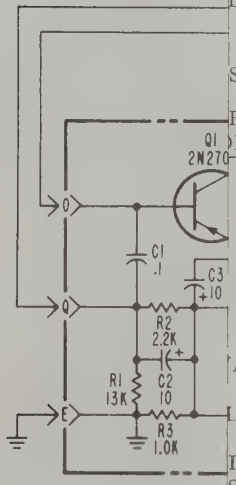
Figure 5-11. C-92A Control Unit, Wiring Diagram

Figure 5-12. IN-14 Course Indicator, Schematic Diagram

Figure 5-13. CT-11A Compass Transmitter, Schematic Diagram



SIGNATIONS FOR PLUG-IN ASSEMBLIES ARE ABBREVIATED. IDENTIFICATION, PREFIX THE PART DESIGNATION WITH DESIGNATION A1, A2, A3, A4, OR A5; FOR EXAMPLE, A1R1.



AMPLIFIER MAIN ASSEMBLY WIRING DIAGRAM, SEE SOCIATED WIRING DIAGRAMS ARE AS FOLLOWS:

REF DESIG	NAME	FIGURE NO.
A1	COMPUTER	5-3
A2	TRACK BRIDGE	5-4
A3	SLAVING #2	5-5
A4	SLAVING #1	5-6
A5	INVERTER	5-7
A5	POWER TRANSFORMER	5-8

ALUES ARE IN MICROFARADS (μF).

LUES ARE IN OHMS; MULTIPLIER K=1000.

IVE A5 MODULES MAY BE USED. THE POWER TRANSFORMER SED IN AIRCRAFT THAT HAVE A 115V, 400-CPS POWER NVERTER MODULE A5 IS USED IN AIRCRAFT THAT DO NOT 0-CPS POWER SOURCE AVAILABLE.

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Figure 5-1. CA-12A Computer Amplifier, Schematic Diagram

SECTION V

DIAGRAMS

Figure 5-1. CA-12A Computer Amplifier, Schematic Diagram

Figure 5-2. CA-12A Computer Amplifier Chassis, Wiring Diagram

Figure 5-3. CA-12A Computer Amplifier, Computer Assembly A1, Wiring Diagram

Figure 5-4. CA-12A Computer Amplifier Track Bridge Assembly A2, Wiring Diagram

Figure 5-5. CA-12A Computer Amplifier Slaving No. 2 Assembly A3, Wiring Diagram

Figure 5-6. CA-12A Computer Amplifier Slaving No. 1 Assembly A4, Wiring Diagram

Figure 5-7. CA-12A Computer Amplifier Inverter Assembly A5, Wiring Diagram

Figure 5-8. CA-12A Computer Amplifier Power Transformer Assembly A5, Wiring Diagram

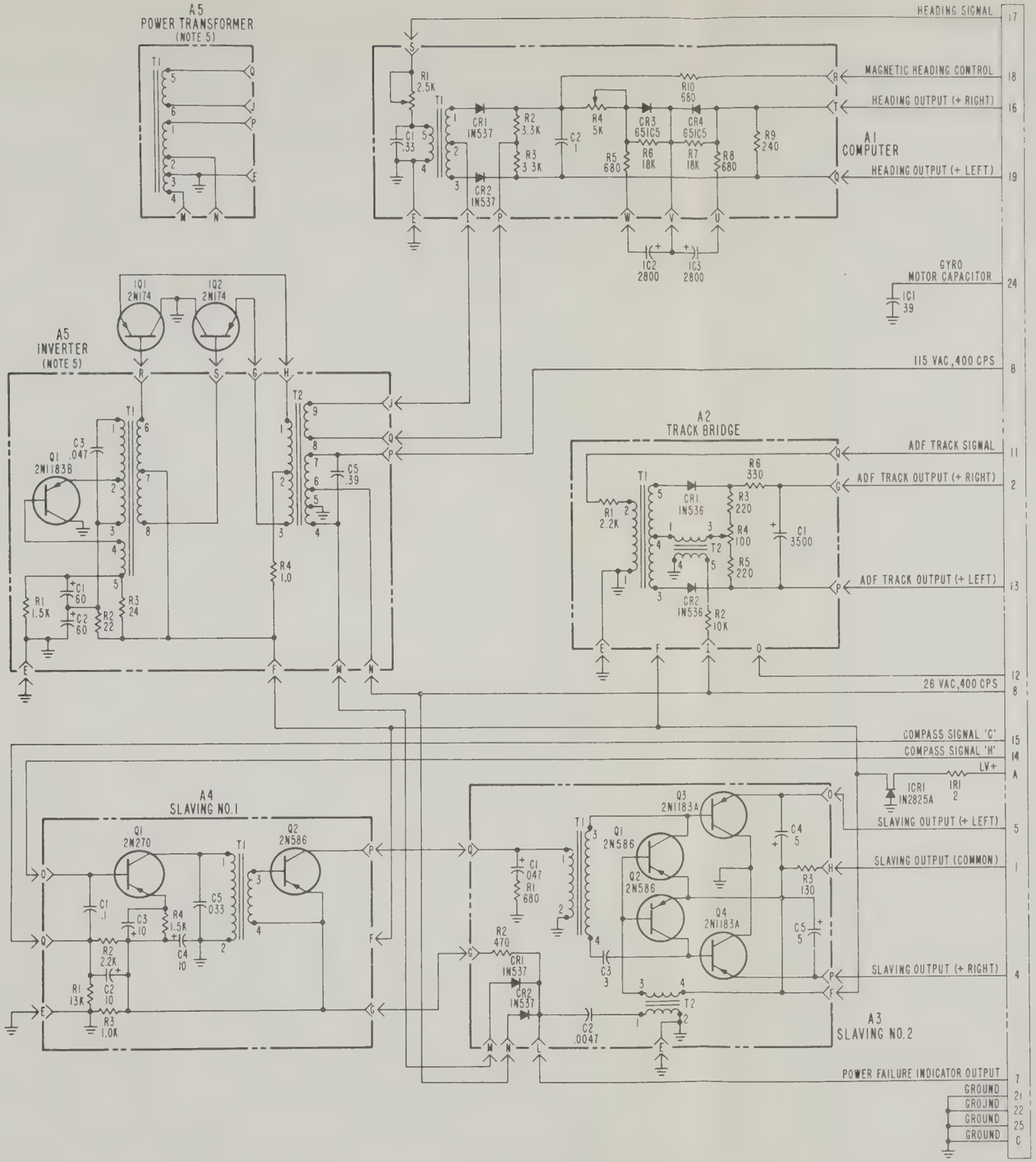
Figure 5-9. G-13A Gyro Indicator, Schematic Diagram

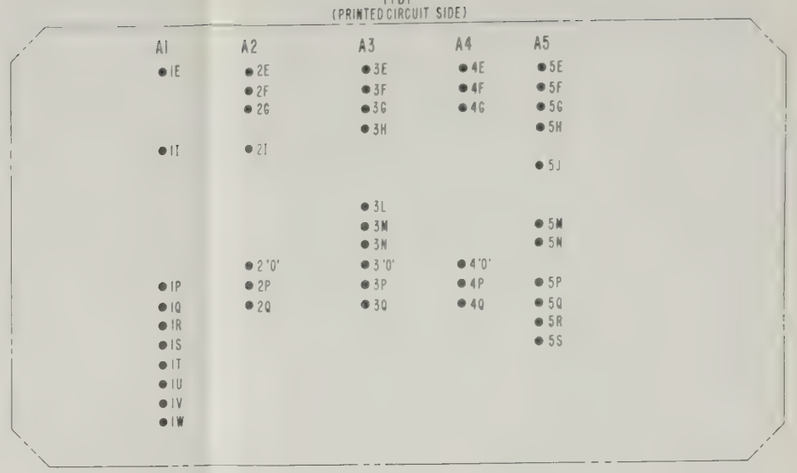
Figure 5-10. C-92A Control Unit, Schematic Diagram

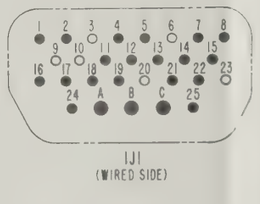
Figure 5-11. C-92A Control Unit, Wiring Diagram

Figure 5-12. IN-14 Course Indicator, Schematic Diagram

Figure 5-13. CT-11A Compass Transmitter, Schematic Diagram







NOTES:

1. REFERENCE DESIGNATIONS FOR PLUG-IN ASSEMBLIES ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A1, A2, A3, A4, OR A5: FOR EXAMPLE, A1R1.

2. FOR COMPUTER AMPLIFIER MAIN ASSEMBLY WIRING DIAGRAM, SEE FIGURE 5-2. ASSOCIATED WIRING DIAGRAMS ARE AS FOLLOWS:

REF DESIG	NAME	FIGURE NO.
A1	COMPUTER	5-3
A2	TRACK BRIDGE	5-4
A3	SLAVING #2	5-5
A4	SLAVING #1	5-6
A5	INVERTER	5-7
A5	POWER TRANSFORMER	5-8

3. CAPACITANCE VALUES ARE IN MICROFARADS (μF).

4. RESISTANCE VALUES ARE IN OHMS; MULTIPLIER K=1000.

5. TWO ALTERNATIVE A5 MODULES MAY BE USED. THE POWER TRANSFORMER MODULE A5 IS USED IN AIRCRAFT THAT HAVE A 115V, 400-CPS POWER SOURCE. THE INVERTER MODULE A5 IS USED IN AIRCRAFT THAT DO NOT HAVE A 115V, 400-CPS POWER SOURCE AVAILABLE.

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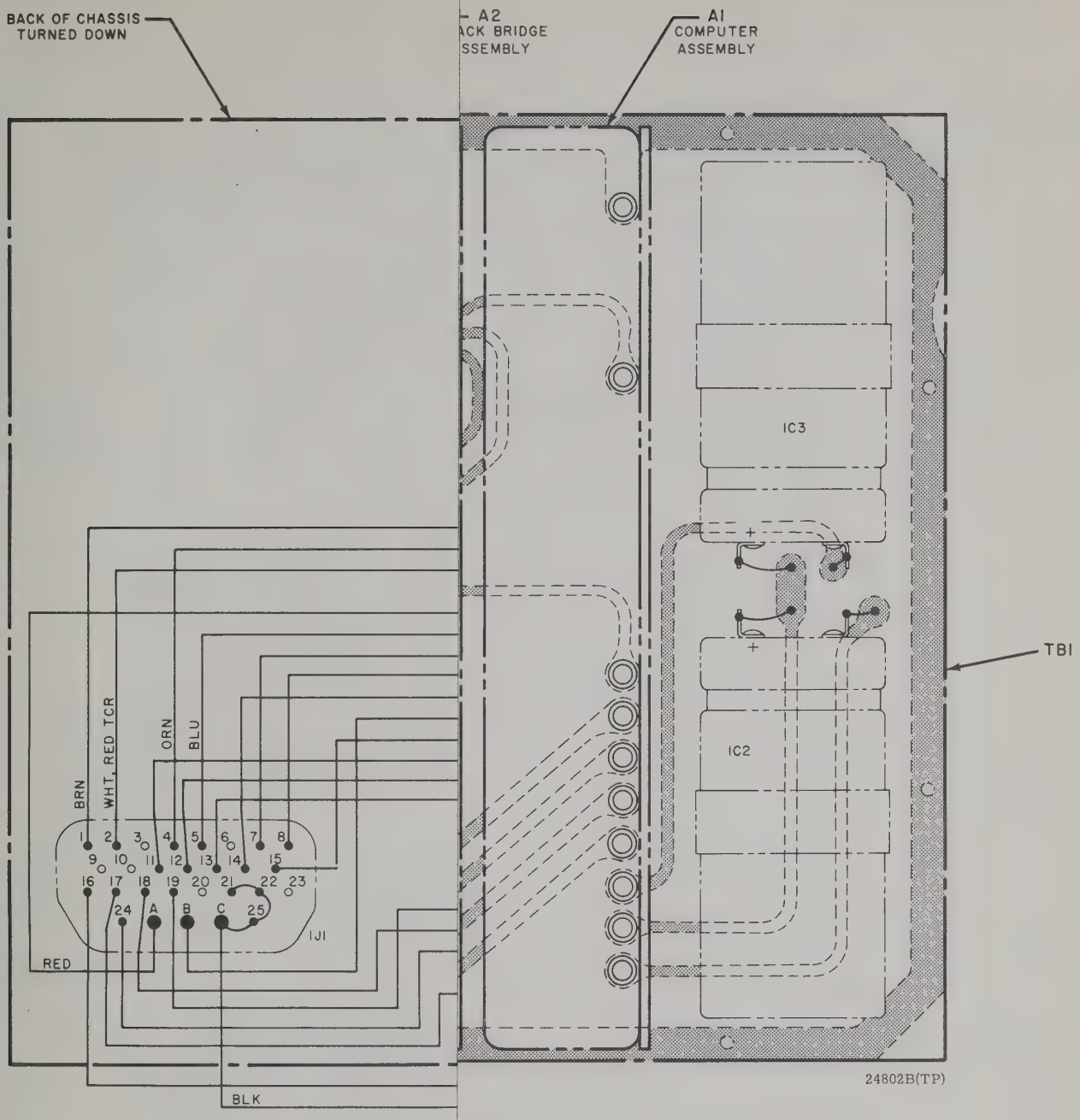
Figure 5-1. CA-12A Computer Amplifier, Schematic Diagram



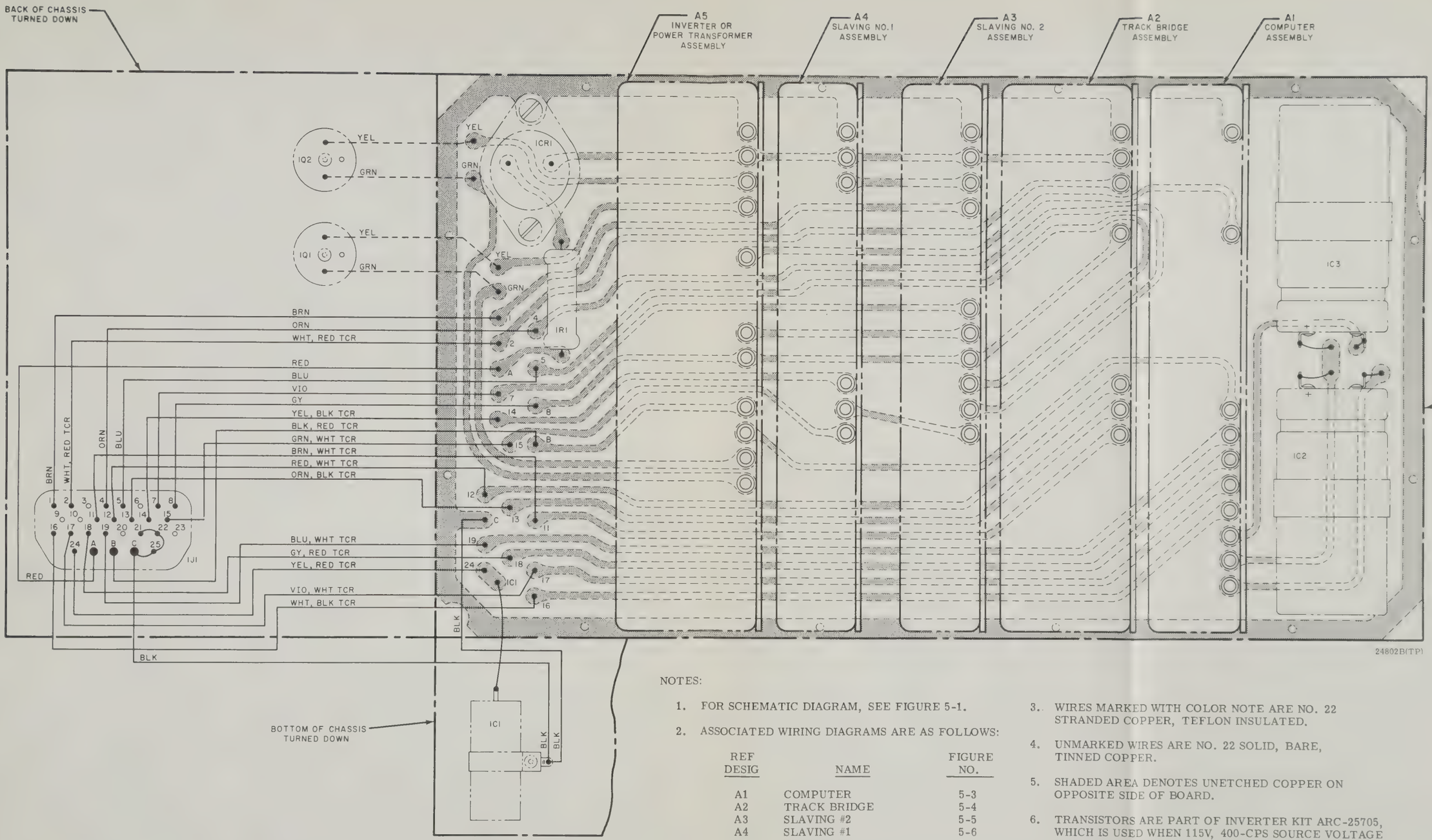
ED WITH COLOR NOTE ARE NO. 22
OPPER, TEFLON INSULATED.

VIRES ARE NO. 22 SOLID, BARE,
PER.

A DENOTES UNETCHED COPPER ON
DE OF BOARD.

ARE PART OF INVERTER KIT ARC-25705,
D WHEN 115V, 400-CPS SOURCE VOLTAGE
ABLE. YELLOW AND GREEN LEADS ARE
TH TRANSISTORS.

Figure 5-2. CA-12A Computer Amplifier Chassis, Wiring Diagram



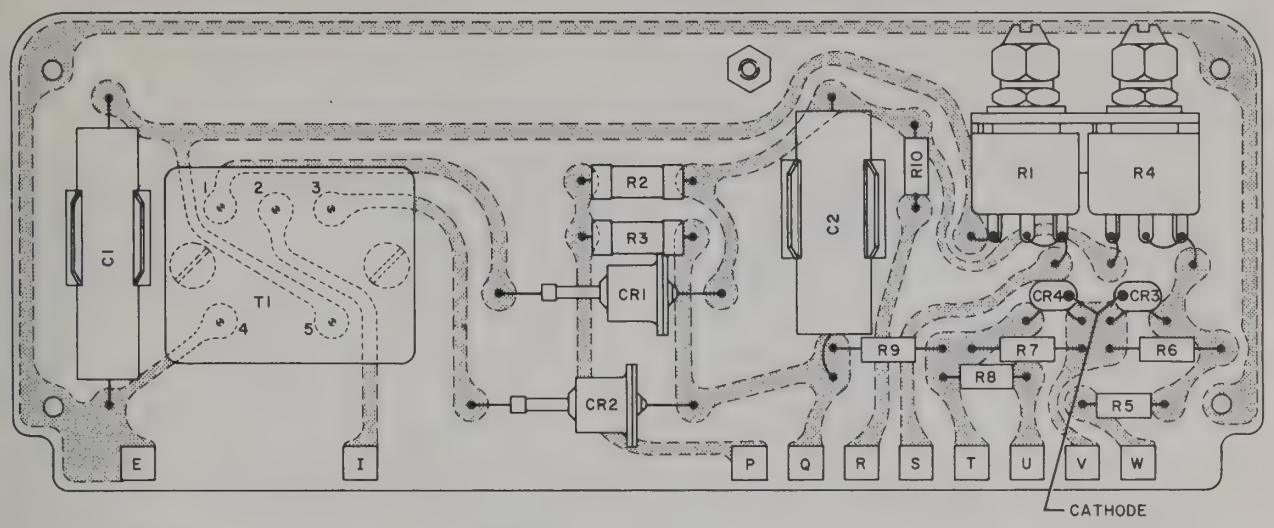
NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 5-1.
2. ASSOCIATED WIRING DIAGRAMS ARE AS FOLLOWS:

REF DESIG	NAME	FIGURE NO.
A1	COMPUTER	5-3
A2	TRACK BRIDGE	5-4
A3	SLAVING #2	5-5
A4	SLAVING #1	5-6
A5	INVERTER	5-7
A5	POWER TRANSFORMER	5-8

3. WIRES MARKED WITH COLOR NOTE ARE NO. 22 STRANDED COPPER, TEFLON INSULATED.
4. UNMARKED WIRES ARE NO. 22 SOLID, BARE, TINNED COPPER.
5. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.
6. TRANSISTORS ARE PART OF INVERTER KIT ARC-25705, WHICH IS USED WHEN 115V, 400-CPS SOURCE VOLTAGE IS NOT AVAILABLE. YELLOW AND GREEN LEADS ARE SUPPLIED WITH TRANSISTORS.

Figure 5-2. CA-12A Computer Amplifier Chassis, Wiring Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A1; FOR EXAMPLE, A1R1.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 5-1.
3. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

Figure 5-3. CA-12A Computer Amplifier Computer Assembly A1, Wiring Diagram

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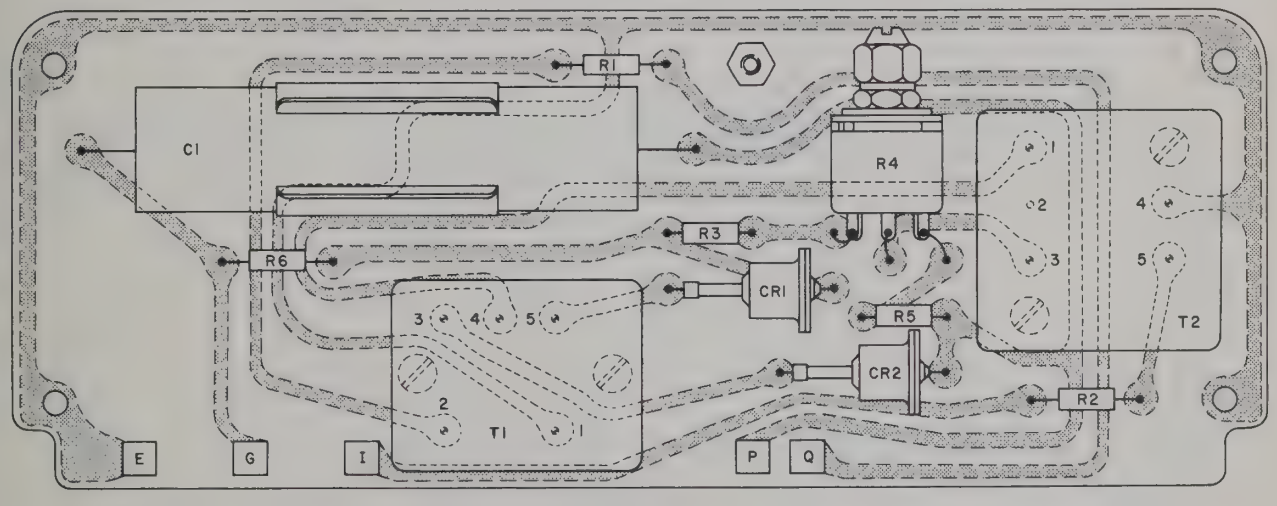

NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A2; FOR EXAMPLE, A2R1
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 5-1.
3. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

Figure 5-4. CA-12A Computer Amplifier Track Bridge Assembly A2, Wiring Diagram

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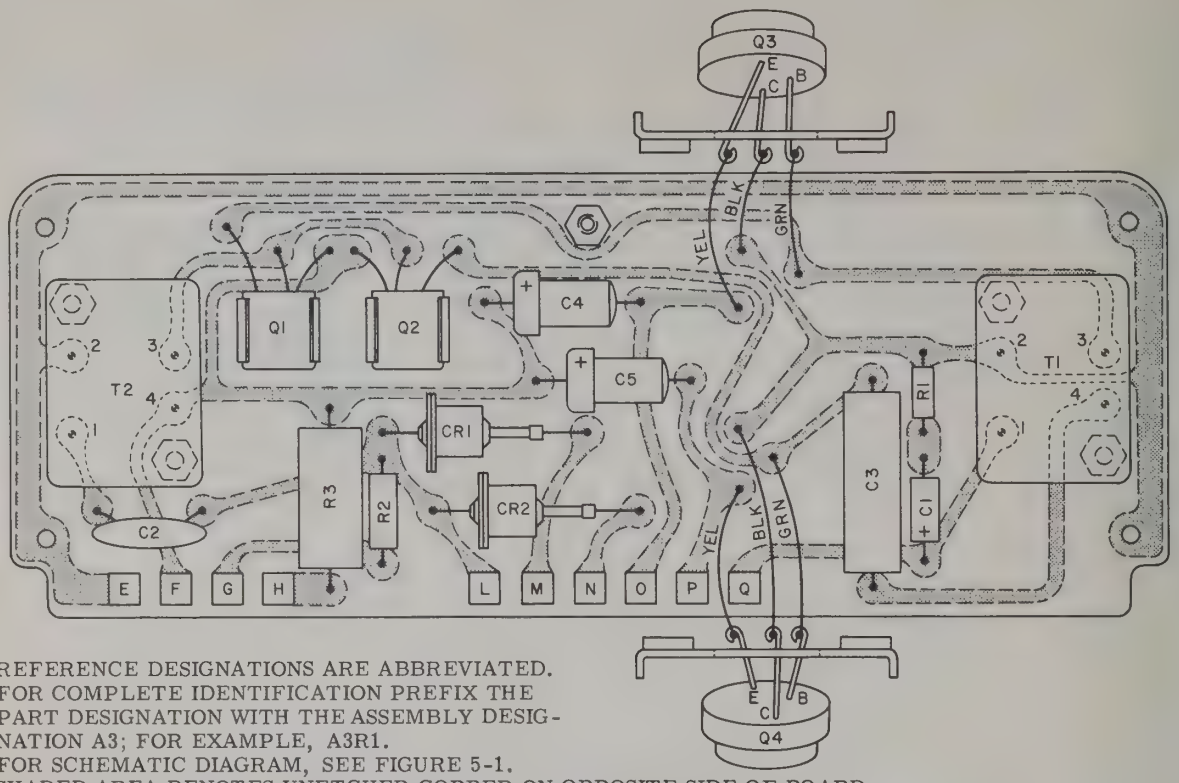

NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A3; FOR EXAMPLE, A3R1.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 5-1.
3. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.
4. WIRES MARKED WITH COLOR NOTE ARE NO. 22 STRANDED, SILVER-PLATED COPPER, TEFLON INSULATED.

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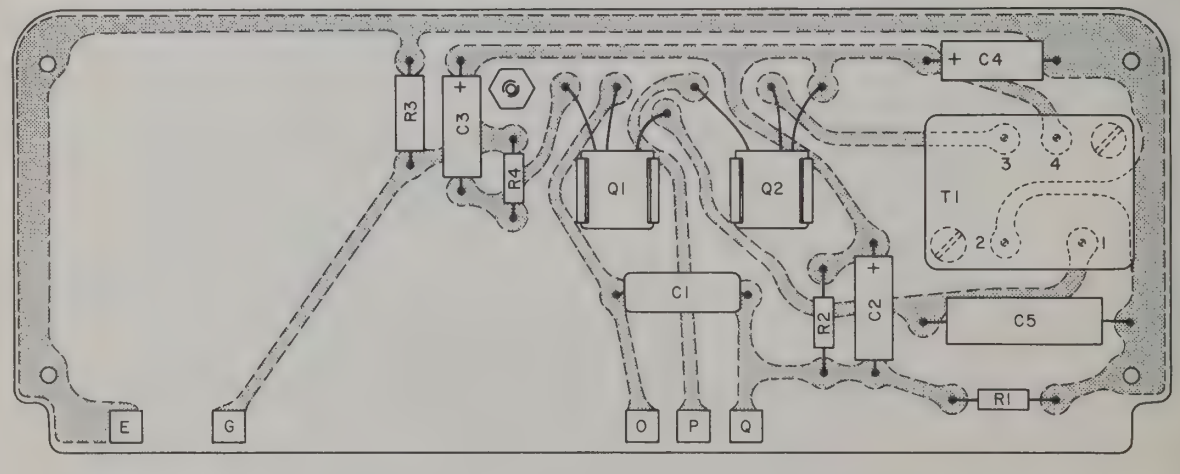
Figure 5-5. CA-12A Computer Amplifier Slaving No. 2 Assembly A3, Wiring Diagram



NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A4, FOR EXAMPLE, A4R1.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 5-1.
3. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

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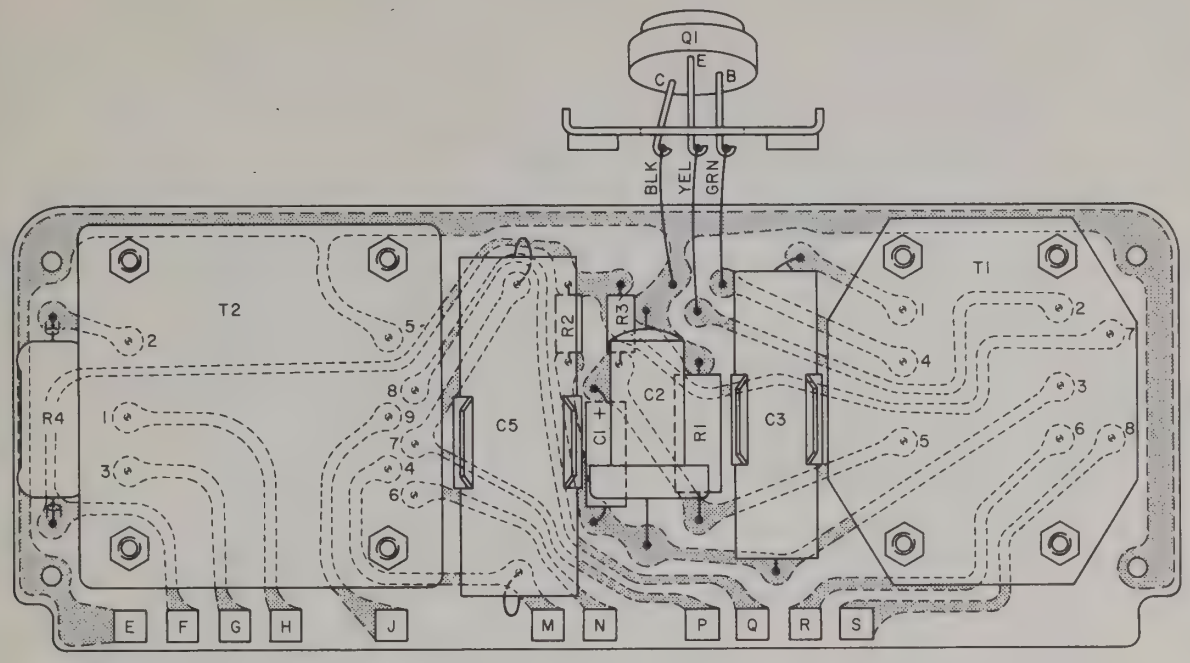
Figure 5-6. CA-12A Computer Amplifier Slaving No. 1 Assembly A4, Wiring Diagram



NOTES:

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. FOR COMPLETE IDENTIFICATION, PREFIX THE PART DESIGNATION WITH THE ASSEMBLY DESIGNATION A5; FOR EXAMPLE, A5R1.
2. FOR SCHEMATIC DIAGRAM, SEE FIGURE 5-1.
3. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.
4. WIRES MARKED WITH COLOR NOTE ARE NO. 22 STRANDED, SILVER-PLATED COPPER, TEFLON INSULATED.

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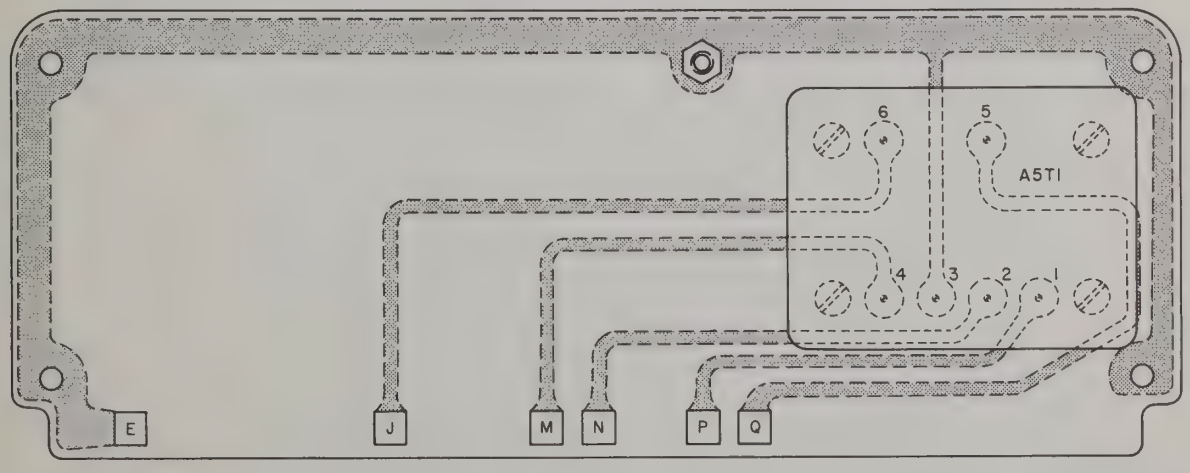
Figure 5-7. CA-12A Computer Amplifier Inverter Assembly A5, Wiring Diagram



NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 5-1.
2. SHADED AREA DENOTES UNETCHED COPPER ON OPPOSITE SIDE OF BOARD.

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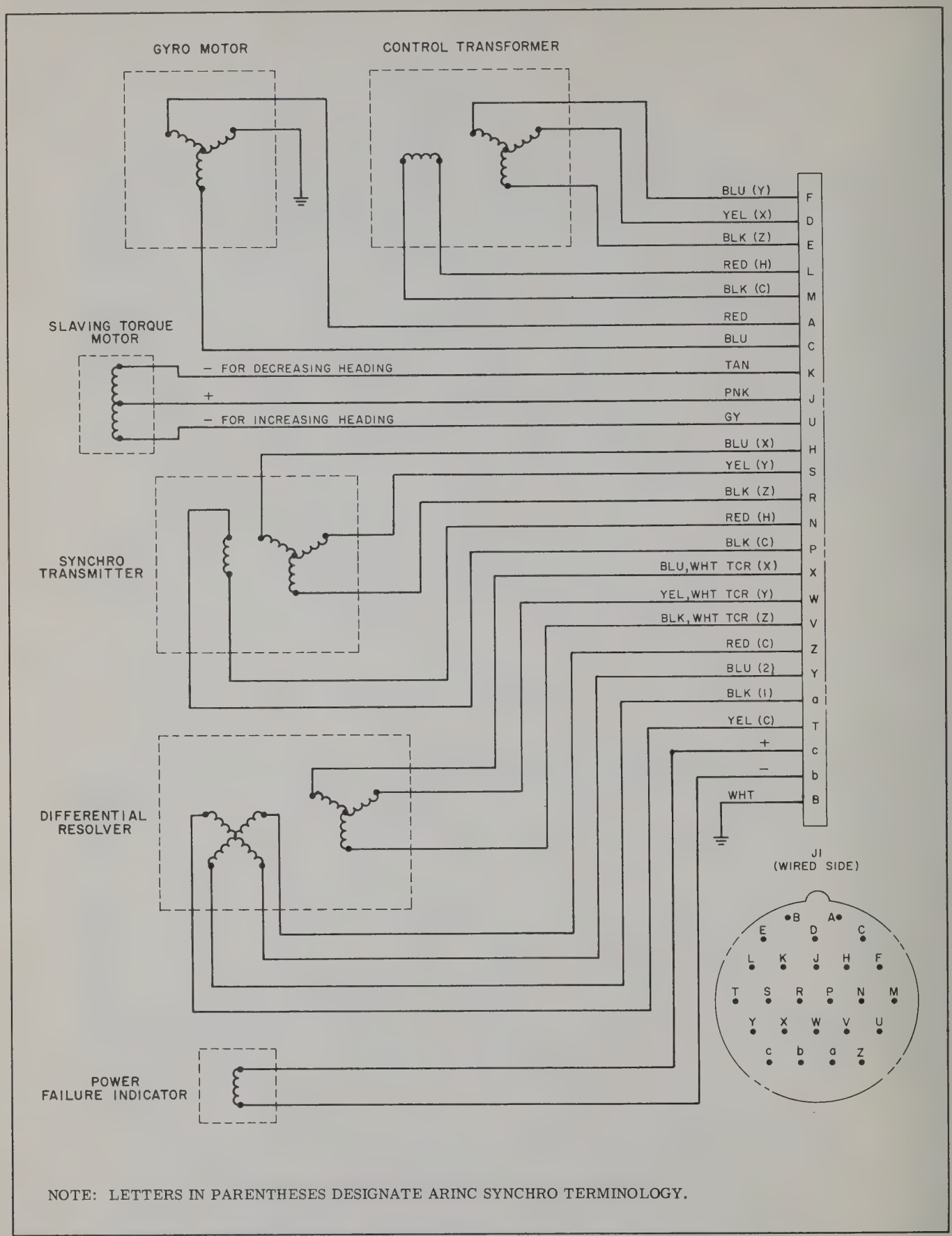
Figure 5-8. CA-12A Computer Amplifier Power Transformer Assembly A5, Wiring Diagram



NOTE: LETTERS IN PARENTHESES DESIGNATE ARINC SYNCHRO TERMINOLOGY.

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Figure 5-9. G-13A Gyro Indicator, Schematic Diagram

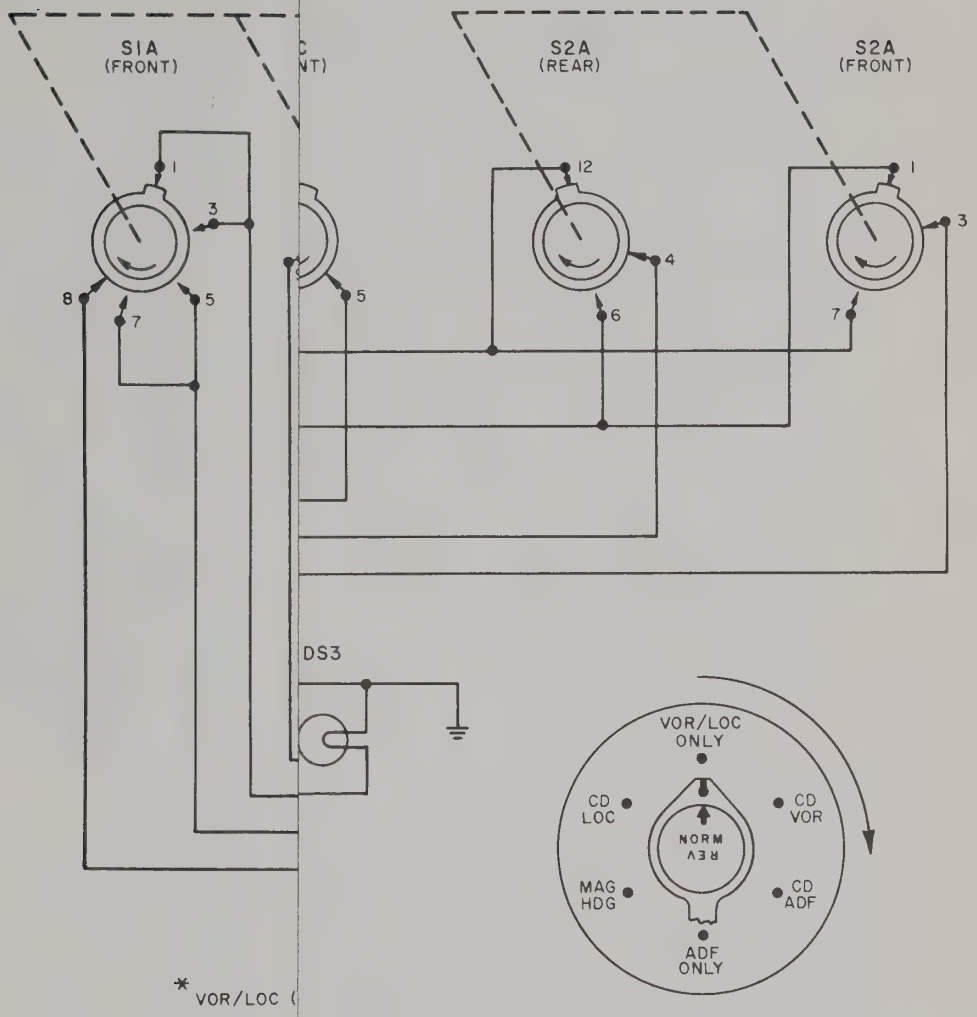

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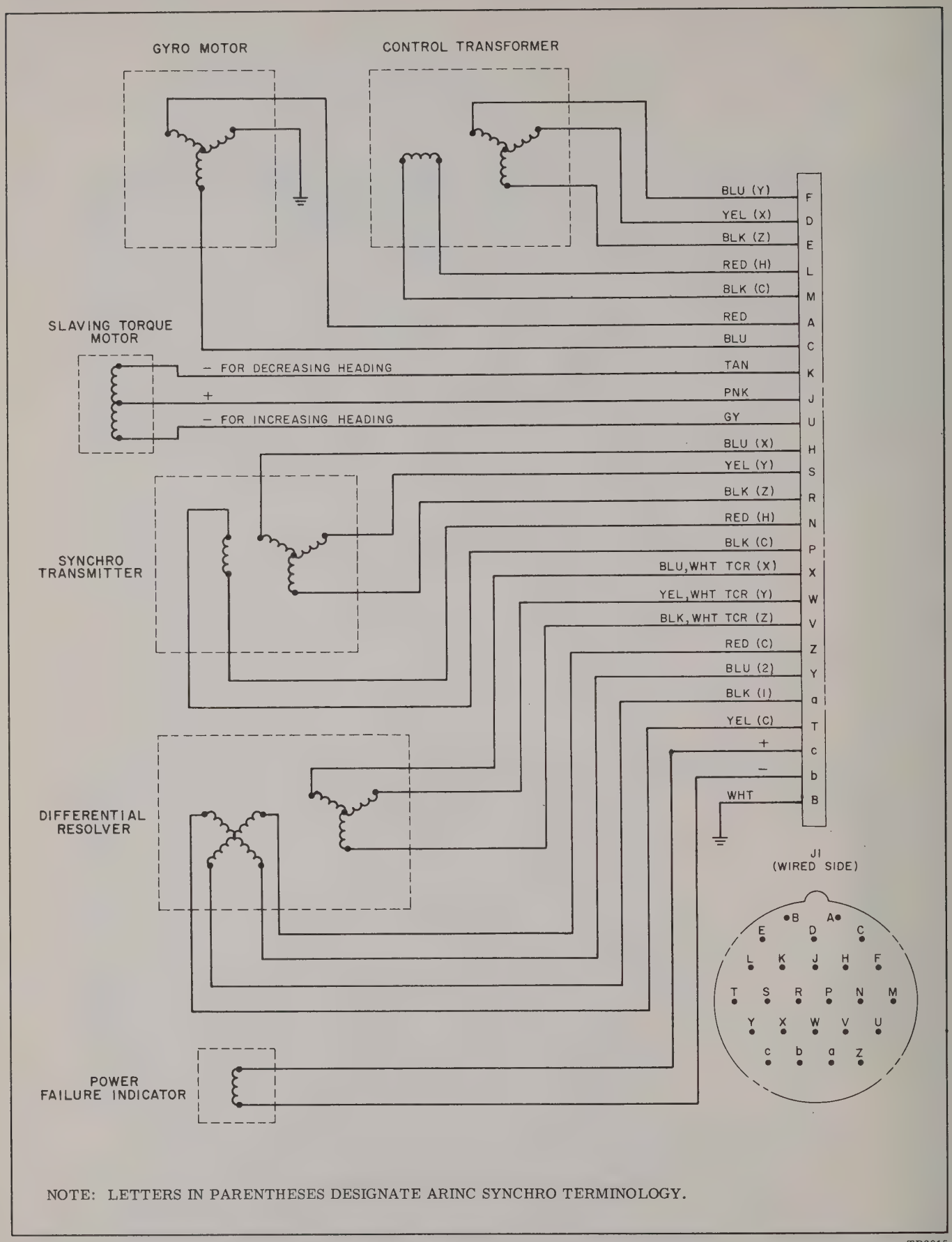
Figure 5-10. C-92A Control Unit, Schematic Diagram



NOTE: LETTERS IN PARENTHESES DESIGNATE ARINC SYNCHRO TERMINOLOGY.

TP3015

Figure 5-9. G-13A Gyro Indicator, Schematic Diagram

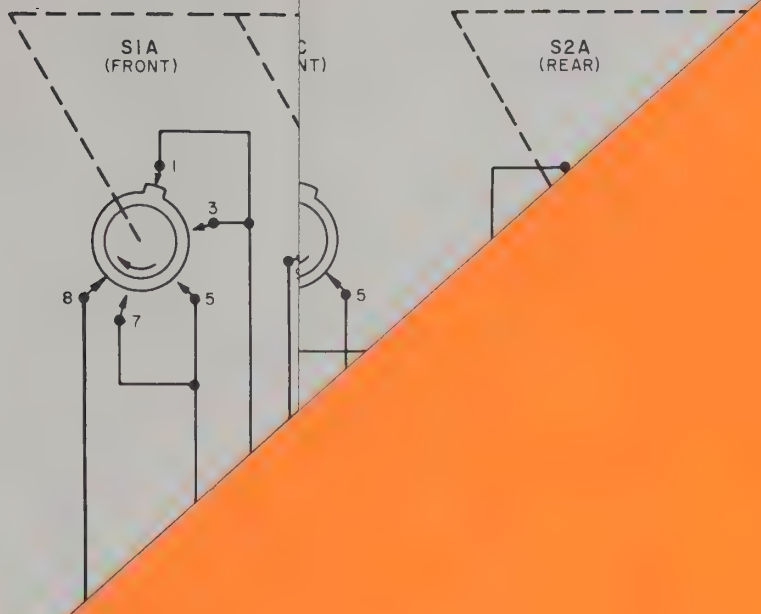
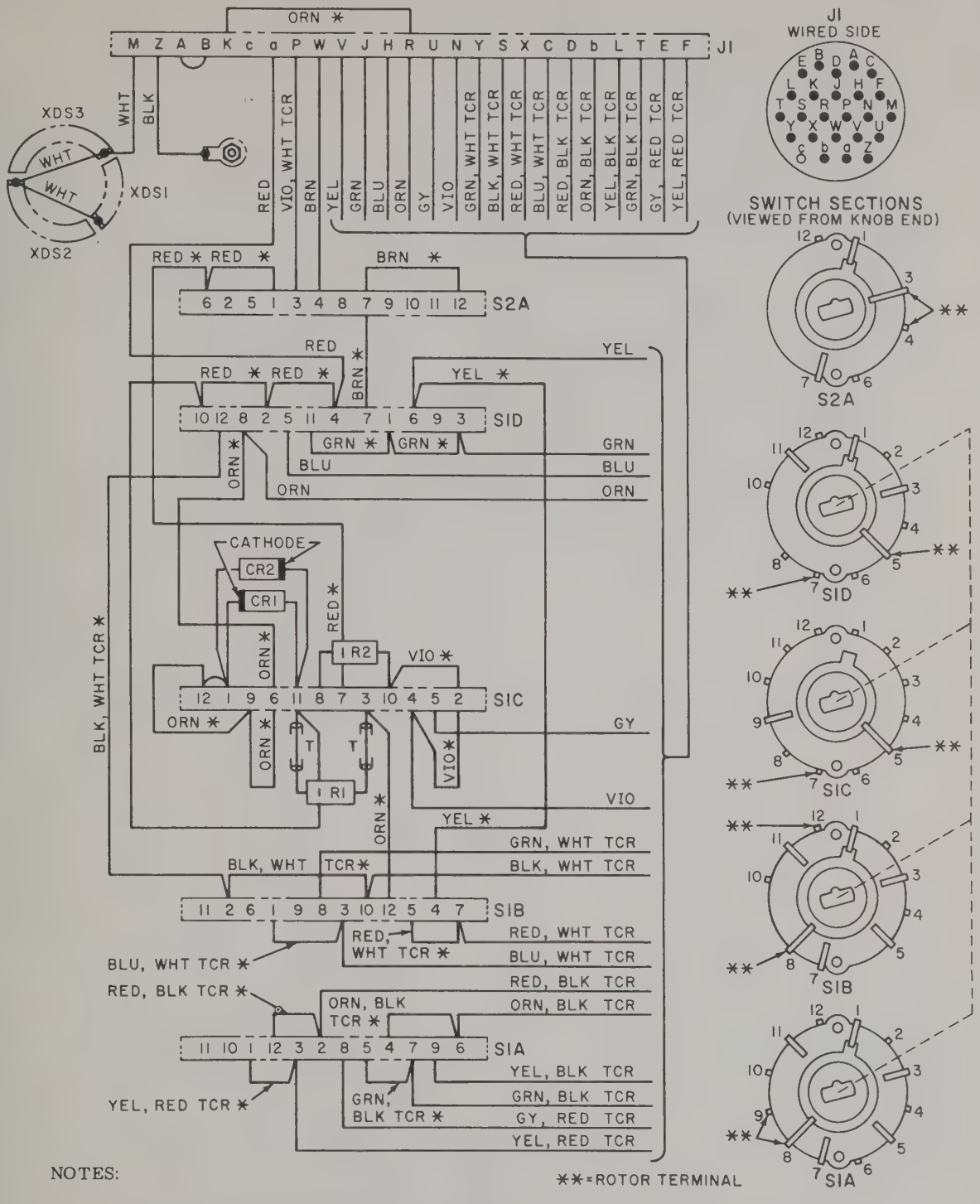


Figure 5-1
Schem



NOTES:

1. FOR SCHEMATIC DIAGRAM, SEE FIGURE 5-10.
2. WIRES MARKED WITH COLOR NOTE ONLY ARE NO. 22 STRANDED COPPER, TEFLON INSULATED.
3. WIRES MARKED WITH COLOR NOTE AND AN ASTERISK (*) ARE NO. 24 SOLID COPPER, TEFLON INSULATED.
4. UNMARKED WIRES ARE NO. 24 BARE, SOLID, TINNED COPPER.
5. TEFLON TUBING (0.036 INCH I.D.) IS INSTALLED OVER LEADS MARKED "T" ON RESISTOR R1.

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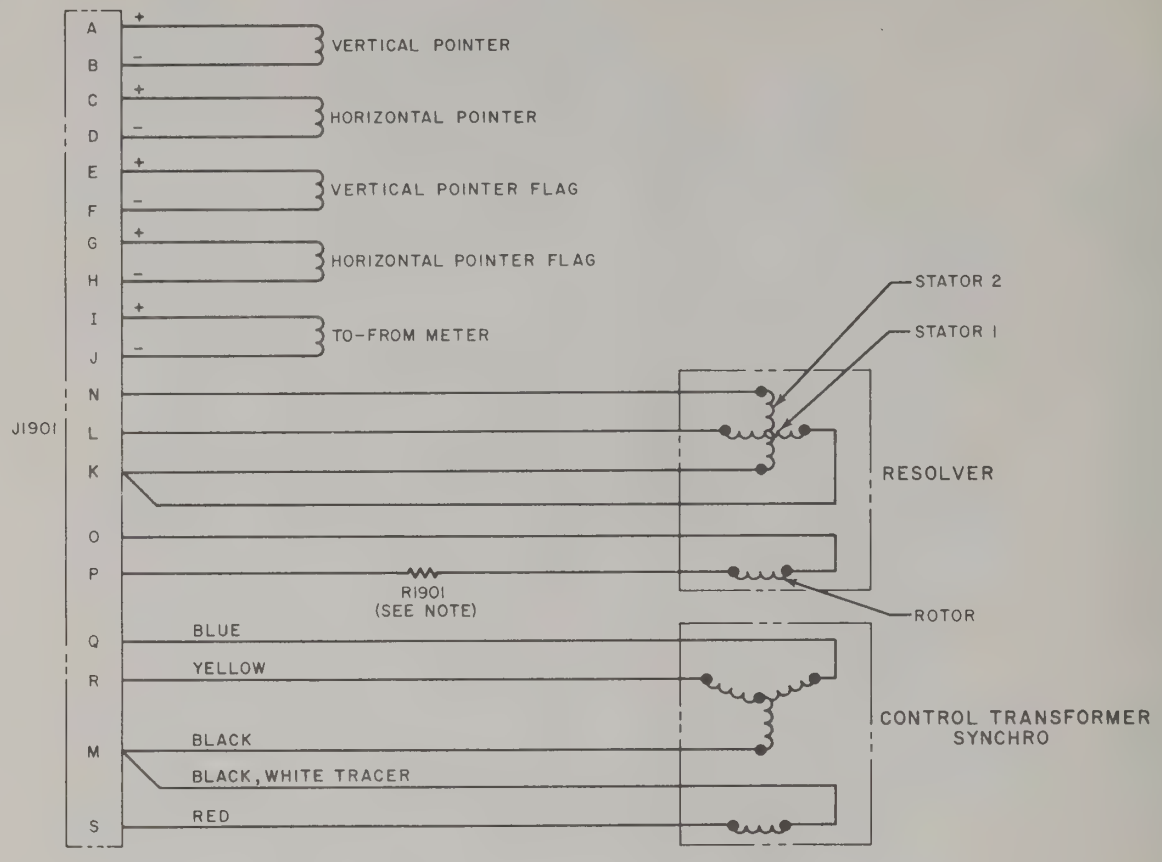
Figure 5-11. C-92A Control Unit, Wiring Diagram



MECHANISM	RECEPTACLE + PINS -		DEFLECTION	SENSITIVITY (MICROAMPERES)	RESISTANCE (OHMS)
VERTICAL POINTER	A	B	RIGHT	150-0-150 ±7.5	1000 ±30
HORIZONTAL POINTER	C	D	DOWN	150-0-150 ±7.5	1000 ±30
VERTICAL POINTER FLAG	E	F	DOWN	180 MIN SUPPRESSED 245 ±11 CONCEALED	1000 ±30
HORIZONTAL POINTER FLAG	G	H	RIGHT	180 MIN SUPPRESSED 245 ±11 CONCEALED	1000 ±30
TO-FROM METER	I	J	TO	90-0-90 ±15	335 ±67

RESOLVER	RECEPTACLE PINS		RESISTANCE (OHMS)
STATOR NO. 1	GREEN YELLOW	K L	1040 ±125
STATOR NO. 2	GRAY BLACK	K N	1040 ±125
ROTOR CIRCUIT	RED WHITE	O P	2350-3200

NOTE: VALUE DETERMINED AT TIME OF ASSEMBLY.

TP2015

Figure 5-12. IN-14 Course Indicator, Schematic Diagram

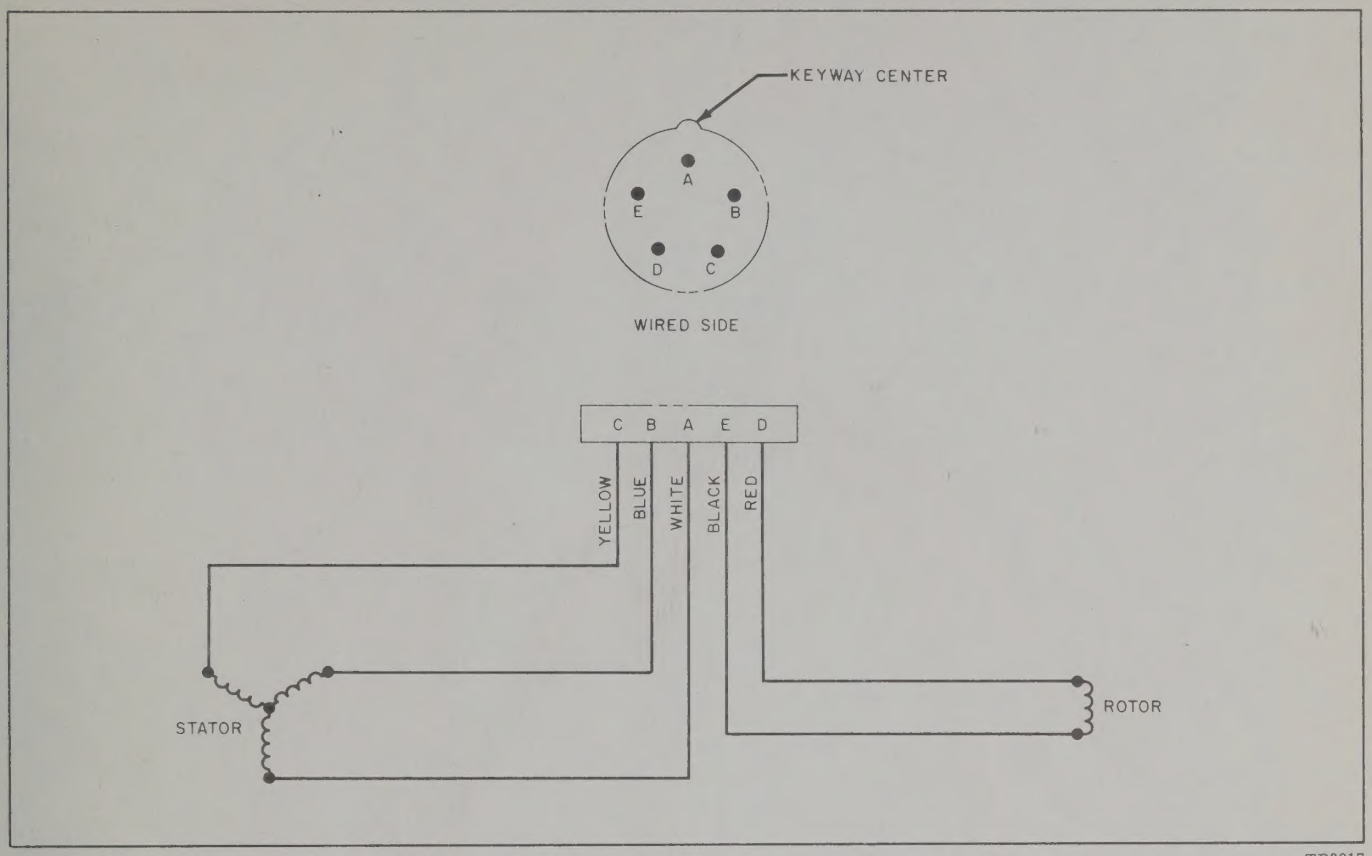


Figure 5-13. CT-11A Compass Transmitter, Schematic Diagram

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